

N00217_001539
NS HUNTERS POINT, CA
SSIC 5000-33a

**FINAL SAMPLING AND ANALYSIS PLAN (FIELD SAMPLING PLAN AND
QUALITY ASSURANCE PROJECT PLAN) FOR RADIOLOGICAL SCREENING
AND DATA GAP INVESTIGATION AT PARCEL F**

02/09/2009
BATTELLE

**NOTIFICATION: This Record Contains Sensitive But Unclassified Information
Which is Protected by a Freedom of Information Act Exemption(s)**

FOIA EXEMPTION 4. (5 USC 552(b)(4))
Privileged/Confidential Trade Secrets, Commercial, Financial Information
Pages: 152-174

Distribution authorized to U.S. Government Agencies only.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #1 – Title and Approval Page

FINAL

**SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)**

February 9, 2009

for

RADIOLOGICAL SCREENING AND DATA GAP INVESTIGATION

at

**PARCEL F
HUNTERS POINT SHIPYARD
SAN FRANCISCO BAY, CALIFORNIA**

Prepared for:

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, CA 92108-4310

Prepared by:

Battelle
505 King Avenue
Columbus, Ohio 43201

Prepared under:

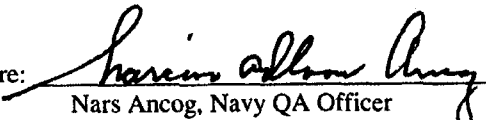
Contract No. N62473-08-D-8824
Task Order No. 0002
DCN: BATL-8824-0002-0002

Review Signature: _____


Betsy Cufé, Battelle ER QA Officer

Date: 2/9/09

Approval Signature: _____


Nars Ancog, Navy QA Officer

Date: 2/9/2009

EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP) has been prepared to support work to be performed by Battelle for the Naval Facilities Engineering Command (NAVFAC) Southwest at Parcel F, Hunters Point Shipyard (HPS), San Francisco, California. This Data Gap Investigation SAP has been prepared under the NAVFAC Southwest, Indefinite Delivery/Indefinite Quantity, Environmental Multiple Award Contract (EMAC) No. N62473-07-D-3212/X001, in support of radiological investigations at Parcel F, HPS, California. The shipyard is located on a peninsula in the southeast corner of San Francisco, CA, and is bounded on the north, east, and south by San Francisco Bay and on the west by the Bayview Hunters Point district. HPS comprises approximately 955 acres, with approximately 400 acres of offshore sediments. Parcel F includes all of the areas at HPS from approximately the mean low tide level to the offshore property boundaries.

Navy operations at HPS have included the use and disposal of radionuclides for over 60 years. The Navy published the Historical Radiological Assessment (HRA), a comprehensive study that describes all documented operations at HPS involving radionuclides. The HRA covers 64 years of radiological activities at HPS from 1939 through June 2003. Historical radiological operations include:

- The repair, use, and disposal of radioluminescent commodity items (dials, gauges, and deck markers)
- Gamma radiography for testing of materials, calibration laboratory operations for ensuring radiation survey equipment accuracy
- Decontamination of and scientific research on ships contaminated during atomic weapons testing, and
- Use of various radionuclides for scientific research by the Naval Radiological Defense Laboratory (NRDL) and its predecessors.

The HRA includes contamination data from onshore buildings and areas, but almost no data have been collected in the aquatic areas of Parcel F. This study is being performed to address the data gaps that exist for quantifying the nature and extent of radioactive contamination within the offshore sediments of Parcel F.

The goals of this SAP are to:

1. Describe in detail the data collection and analysis plan for the first phase (screening study)
2. Communicate that a second phase, the Data Gap Investigation [DGI] will follow and be based on information from the screening phase.

After the first phase is complete, an addendum to this SAP will describe the DGI sample and analysis plan in detail. The addendum will also describe how data from the DGI and the screening study will be supported with existing non-radionuclide data from previous Parcel F studies and existing radiological data to build a Radiological Addendum to the Feasibility Study (FS) for Parcel F. The Radiological Addendum to the Feasibility Study will evaluate human health and ecological risk and dose concerns posed by the Radiological DGI findings, determine if and where remedial options need to be developed for radiological contamination, and outline, analyze, and compare available remediation options.

SAP Worksheets:

#1 - Title and Approval Page	1
#2 - SAP Identifying Information	7
#3 - Distribution List.....	11
#4 - Project Personnel Sign-Off Sheet	14
#5 - Project Organizational Chart	15
#6 - Communication Pathways	16
#7 - Personnel Responsibilities and Qualification Table	17
#8 - Special Personnel Training Requirements Table.....	22
#9 - Project Scoping Sessions Participants Sheet	23
#10 - Problem Definition	28
#11 - Project Quality Objectives/Systematic Planning Process Statements	35
#12 - Measurement Performance Criteria Table – Sediment.....	38
#13 - Secondary Data Criteria and Limitations Table	39
#14 - Summary of Project Tasks	41
#15 - Reference Limits and Evaluation Table	47
#16 - Project Schedule Timeline Table.....	48
#17 - Sampling Design and Rationale.....	51
#17-1 - Sampling Design and Rationale for the Submarine Base Area.....	55
#17-2 - Sampling Design and Rationale for the Berths-North Area.....	56
#17-3 - Sampling Design and Rationale for the Berths – South Area	57
#17-4 - Sampling Design and Rationale for the South Basin Area.....	58
#18 - Sampling Locations and Methods/SOP Requirements Table.....	70
#19 - Analytical SOP Requirements Table	72
#20 - Field Quality Control Sample Summary Table	74
#21 - Project Sampling SOP References Table	75
#22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table.....	76
#23 - Analytical SOP References Table	81
#24 - Analytical Instrument Calibration Table	82
#25 - Analytical and Equipment Maintenance, Testing, and Inspection Table	86
#26 - Sample Handling System.....	90
#27 - Sample Custody Requirements.....	91
#28 - Laboratory QC Samples Table for Soil Samples.....	94
#29 - Project Documents and Records Table.....	101
#30 - Analytical Services Table	102
#31 - Planned Project Assessments Table.....	104
#32 - Assessment Finding and Corrective Action Responses.....	105
#33 - QA Management Reports Table	106
#34 - Verification (Step I) Process Table.....	107
#35 - Validation (Steps IIa and IIb) Process Table	108
#36 - Analytical Data Validation (Steps IIa and IIb) Summary Table.....	109
#37 - Usability Assessment.....	110
REFERENCES	114

List of Figures

Figure 10-1. Study Site Overview.....	30
Figure 10-2. Impacted Sites as Reported in the HRA (Source: U.S. Navy, 2004)	31
Figure 17-1. Proposed Sampling Locations for HPS Parcel F.....	54
Figure 17-2. Proposed Sampling Locations for the Submarine Area	55
Figure 17-3. Proposed Sampling Locations for the Berths – North Area	56
Figure 17-4. Proposed Sampling Locations for the Berths – South Area	57
Figure 17-5. Proposed Sampling Locations for the South Basin Area	58

List of Tables

Table 9-1. Project Kick-Off Meeting.....	23
Table 9-2. Miscellaneous Telephone Conferences with Navy RPM.....	27
Table 11-1. Project Quality Objectives.....	37
Table 17-1. Screening Survey Summary of Proposed Samples with General Rationale	53
Table 17-2. Station Locations for the Screening Survey	59
Table 18-1. Screening Survey Sampling Methods and SOPs.....	71

List of Attachments

#14-1: Field Checklist.....	46
#17-1: Summary of Field Sampling Methods.....	63
#17-2. Forms.....	66
#27-1: Chain of Custody Record	92
#27-2: Custody Seal.....	93
ATTACHMENT A: Summary of HRA Information.....	115
ATTACHMENT B: Standard Operating Procedures	131

Acronyms

ARAR	applicable or relevant and appropriate requirement
BCT	Base Closure Team
BOC	Buildings of Concern
BRAC	Base Closure and Realignment Program
CalEPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CO/COR	Contracting Officer/Contracting Officer's Representative
COC	chain-of-custody
DGI	Data Gap Investigation
DoD	Department of Defense
DOE	Department of Energy
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
EMAC	Environmental Multiple Award Contract
EWI	Environmental Work Instruction
FS	Feasibility Study
G-RAM	General radioactive material
GPS	Global Positioning System
HASL	Health and Safety Laboratory
HASP	Health and Safety Plan
HRA	Historical Radiological Assessment
HPS	Hunters Point Shipyard
ID	identification
IDW	investigation-derived waste
IR	Installation Restoration
LDC	Laboratory Data Consultants
LIMS	laboratory information management system
MDA	minimal detective activity
MDL	method detection limit
mph	miles per hour
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command NAS
NAVSEA	Naval Sea Systems Command
NIRIS	Naval Installation Restoration Information Solution
NOAA	National Oceanic and Atmospheric Administration
NRDL	Naval Radiological Defense Laboratory

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

NWT	New World Technology
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QA/QC	quality assurance/quality control
QL	quantitation limit
PAL	project action limit
pCi/L	picocuries per liter
PM	Project Manager
PMO	Program Management Office
PPE	personal protective equipment
PQO	project quality objectives
PRC	PRC Environmental Management, Inc.
RAB	Remedial Action Board
RASO	Radiological Affairs Support Office
ROC	radionuclides of concern
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RST	Radiation Safety Technician
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SEI	Sea Engineering, Inc.
SOP	Standard Operating Procedures
SSHP	Site Safety and Health Plan
TtEC	Tetra Tech EC
TDB	to be determined
UFP-QAPP	Uniform Federal Policy for quality Assurance Plans
U.S. EPA	United States Environmental Protection Agency

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #2 - SAP Identifying Information

Site Name: Hunters Point Shipyard Parcel F

Site Location: Former Naval Ship Yard at Hunters Point, San Francisco, CA

Contract Name: EMAC

Contract Number: N62473-08-D-8824

Work Assignment Number: 0002

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (United States Environmental Protection Agency [U.S. EPA], 2005) and *U.S. EPA Guidance for Quality Assurance Project Plans, U.S. EPA QA/G-5, QAMS* (U.S. EPA, 2002).
2. Identify regulatory program: CERCLA
3. This SAP is a project-specific SAP.
4. List dates of scoping sessions that were held:

Scoping Session	Date
<u>Kick-Off Meeting</u>	<u>3 September 2008</u>
<u>Meeting at BRAC San Diego Office</u>	<u>30 September 2008</u>

5. List dates and titles any SAP documents written for previous site work that are relevant to the current investigation: 1) Naval Sea Systems Command (NAVSEA) - Radiological Control Office Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility, Pearl Harbor, HI, Historical Radiological Assessment. Hunters Point Annex Volume 1 Naval Nuclear Propulsion Program, 1999
2) NAVSEA - Historical Radiological Assessment. History of the Use of General Radioactive Materials 1939 - 2003 Hunters Point Shipyard Volume II, 2003.
6. List organizational partners (stakeholders) and connection with lead organization:
Base Realignment and Closure (BRAC) Program Management Office (PMO) West - Lead; Radiological Affairs Support Office (RASO) - document review; Naval Sea System Command Detachment - Site Safety and Health Plan (SSHP) Review; BRAC Closure Team (BCT) - document review; Region IX U.S. EPA - document review; CalEPA DTSC - document review; California Regional Water Quality Control Board (Water Board) - document review; CalEPA Department of Public Health - document review; City of San Francisco Department of Public Health - document review; NOAA - document review; and CalEPA Fish and Game - document review.
7. Lead Organization: NAVFAC Southwest
8. If any required SAP elements and required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusions below:

Not applicable

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #2 - SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Variance from UFP-QAPP
A. Project Management		
<i>Documentation</i>		
1	Title and Approval Page	
2	Table of Contents SAP Identifying Information	
3	Distribution List	
4	Project Personnel Sign-Off Sheet	
<i>Project Organization</i>		
5	Project Organizational Chart	
6	Communication Pathways	
7	Personnel Responsibilities and Qualifications Table	
8	Special Personnel Training Requirements Table	
<i>Project Planning/Problem Definition</i>		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	
10	Problem Definition, Site History, and Background Site Maps (historical and present)	
11	Site-Specific Project Quality Objectives	
12	Measurement Performance Criteria Table	
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	
14	Summary of Project Tasks	
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	
B. Measurement Data Acquisition		
<i>Sampling Tasks</i>		
17	Sampling Design and Rationale	

SAP Worksheet #2 - SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Variance from UFP-QAPP
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Maps	
19	Analytical Methods/SOP Requirements Table	
20	Field Quality Control Sample Summary Table	
21	Project Sampling SOP References Table Sampling SOPs	
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
<i>Analytical Tasks</i>		
23	Analytical SOPs Analytical SOP References Table	
24	Analytical Instrument Calibration Table	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	
<i>Sample Collection</i>		
26	Sample Handling System, Documentation Collection, Tracking, Archiving, and Disposal Sample Handling Flow Diagram	
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	
<i>Quality Control Samples</i>		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	
<i>Data Management Tasks</i>		
29	Project Documents and Records Table	
30	Analytical Services Table Analytical and Data Management SOPs	
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	
32	Assessment Findings and Corrective Action Responses Table	
33	QA Management Reports Table	

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #2 - SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Variance from UFP-QAPP
D. Data Review		
34	Verification (Step I) Process Table	
35	Validation (Steps IIa and IIb) Process Table	
36	Validation (Steps IIa and IIb) Summary Table	
37	Usability Assessment	

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #3 - Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Dane Jensen	Remedial Project Manager (RPM)	BRAC PMO West	619-532-0789	BRAC PMO West 1455 Frazee Road, Suite 900 San Diego, CA 92108 dane.c.jensen@navy.mil
Nars Ancog	Quality Assurance Officer (QAO)	NAVFAC Southwest	619-532-3046	Naval Facilities Engineering Command 1220 Pacific Highway San Diego, CA 92132-5190
Peter Stroganoff	Resident Officer in Charge of Construction (ROICC)	NAVFAC Southwest	510-749-5941	EFA NFEC 2450 Saratoga St., Suite 200 Alameda, CA 94501 peter.stroganoff@navy.mil
Laurie Lowman	Radiological Affairs Support	Radiological Affairs Support Office, Naval Sea System Command Detachment	757-887-4692	Radiological Affairs Support Office Naval Sea System Command Detachment Building 1971 NWS P.O. Drawer 260 Yorktown, VA. 23691-0260 laurie.lowman@navy.mil
Mark Ripperda	U.S. EPA Project Manager	U.S. EPA	415-972-3028	U.S. EPA 75 Hawthorne Street San Francisco, CA. 94105 ripperda.mark@epa.gov
Tom Lanphar	DTSC Project Manager	California EPA Department of Toxics Substances Control (DTSC)	510-540-3776	DTSC 700 Heinz Ave., Bldg. F, Suite 200 Berkeley, CA. 94710-2737 tlanphar@dtsc.ca.gov
Erich Simon	Water Board Project Manager	San Francisco Regional Water Quality Control Board (Water Board)	510-622-2355	San Francisco Water Board 1515 Clay Street, Suite 1400 Oakland, CA 94612 ersimon@waterboards.ca.gov

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #3 - Distribution List (Continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Vandana Kohli	Department of Public Health Project Manager	Cal/EPA Department of Public Health	916-324-1378	Cal/EPA Department of Public Health Environmental Management Branch 1616 Capitol Avenue P.O. Box 997377 Sacramento, CA. 95899-7377 vandana.kohli@cdph.ca.gov
Amy Brownell	City of SF Dept. of Public Health Project Manager	City of SF Dept. of Public Health	415-252-3967	City of SF Dept. of Public Health 1390 Market St., Suite 210 San Francisco, CA. 94102 amy.brownell@sfdph.org
Michael McGowan, PhD	Arc Ecology Project Manager	Arc Ecology	415-643-1190 ext 308	4634 3 rd Street San Francisco, CA 94124 mikemcgowan@arcecolology.org
Karla Brasaemle	U.S. EPA Contractor	U.S. EPA Contractor Tech Law, Inc.	415-281-8730	Tech Law, Inc. 90 New Montgomery St., Suite 1010 San Francisco, CA. 94105 kbrasaemle@techlawinc.com
Keith Fields	Battelle EMAC Program Manager/Senior Technical Manager	Battelle	614-424-7723	Battelle 505 King Avenue Columbus, OH 43201 fieldsk@battelle.org

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #3 - Distribution List (Continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing Address
Eric Foote	Battelle Project Manager	Battelle	614-424-7939	Battelle 505 King Avenue Columbus, OH 43201 foote@battelle.org
Betsy Cutié	Battelle QAO	Battelle	614-424-4899	Battelle 505 King Avenue Columbus, OH 43201 cutiee@battelle.org
John Hardin	Field Team Leader	Battelle	760-476-1415	Battelle Carlsbad Operations 5205 Avenida Encinas; Suite J Carlsbad, CA 92008 hardinj@battelle.org
Steve Maheras	Radiological Risk Expert/Coordinator	Battelle	614-424-4563	Battelle 505 King Avenue Columbus, OH 43201 maheras@battelle.org
Craig Jones	Hydrodynamics and Sediment Transport Lead	Sea Engineering, Inc.	831-421-0871	SEI 200 Washington St. Suite 210 Santa Cruz, CA 95060
Patty White	Site Characterization & Sediment Transport Expert	CH2M Hill	508-360-3214	CH2M Hill 13 Wohelo Drive North Falmouth, MA 02556

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #4 - Project Personnel Sign-Off Sheet

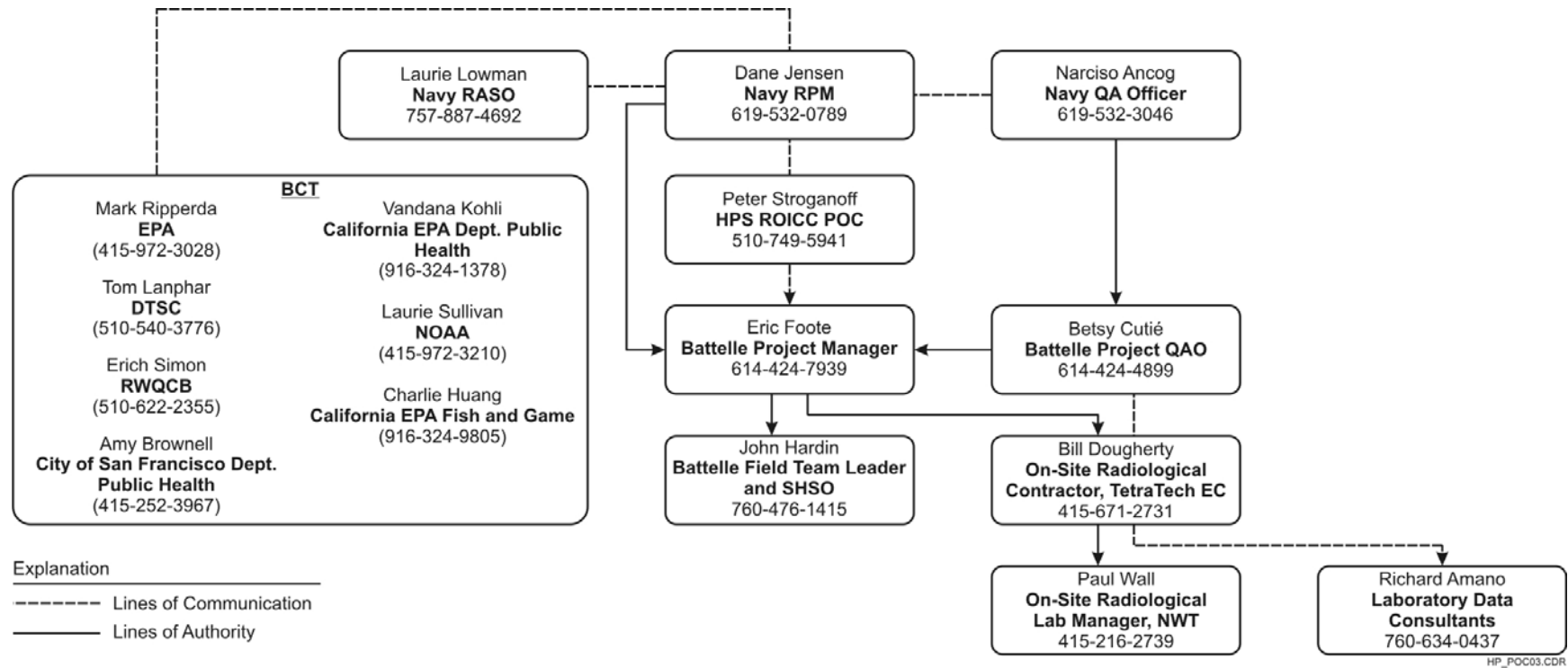
The purpose of the sign-off sheet is to document that key personnel responsible have read and understood the SAP prior to performing their duties.

Project Personnel	Organization/Title/Role	Telephone Number	Signature/Email Receipt	SAP Section Reviewed	Date SAP Read
Keith Fields	Battelle/EMAC Program Manager/Senior Technical Manager	614-424-7723			
Eric Foote	Battelle/Project Manager/Oversee Project	614-424-7939			
John Hardin	Battelle/ Field Team Leader/Oversee Field Work /Site Health and Safety Officer	760-476-1415			
Steve Maheras	Battelle/Senior Research Scientist/Field Sampling and Radiation Analysis	614-424-4563			
Craig Jones	Sea Engineering/ Environmental-Ocean Engineer/Field Sampling and Sediment Transport Analysis	831-421-0871			
Bill Dougherty	Tetra Tech/Project Manager/Radiation Laboratory Support POC	415-216-2731			
Paul Wall	New World Technology, Inc./ Laboratory Project Manager	415-216-2739			
Ivan Vania	Test America/ Laboratory Project Manager	314-298-8566			
Patty White	CH2M Hill/Senior Scientist/Risk Assessor	508-360-3214			
Rich Amano	Laboratory Data Consultants/Project Manager/Oversee Data Validation	760-634-0437			

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #5 – Project Organizational Chart



Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #6 - Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number and/or e-mail	Procedure (Timing, Pathways, etc.)
Monthly briefing to NAVFAC RPM	Battelle Project Manager	Eric Foote	614-424-7939	Monthly phone call from the PM to the RPM
Regular communication with NAVFAC RPM	Battelle Project Manager	Eric Foote	614-424-7939	Frequent communication between the PM to the RPM during field effort either phone call or e-mail
Daily report to Battelle PM and RASO	Battelle Field Team Leader	John Hardin	760-476-1415	Daily updates from Battelle Field Team Leader to Project Manager and RASO during field sampling
Sample receipt notification	Tetra Tech Point of Contact for Analytical Services	Bill Dougherty	415-671-2731	Telephone call and fax or email notification of sample receipt; chain-of-custody review from the Lab Representative to the PM
Real-time modification of SAP activities (e.g., sample location)	Battelle Project Manager	Eric Foote	614-424-7939	A request detailing sampling locations will be sent via e-mail to the RPM. Approval of the changes will be obtained from the RPM, prior to sampling
Regular communication with NAVFAC Southwest QA Officer	Battelle QAO	Betsy Cutié	614-424-4899	Communication via mail to obtain written/formal approval of the planning documents (e.g., SAP) and communication via phone and e-mail to discuss project status and any issues
Regular communication with RASO	Battelle Project Manager	Eric Foote	614-424-7939	Regular communication via e-mail and phone with RASO as laboratory data becomes available

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Dane Jensen	RPM	BRAC PMO West	<ul style="list-style-type: none"> • Final approval for conducting all field activities • Oversight of the overall task order • Approval of selected subcontractors • Execution of contracts • Approval of the release of reports 	
Laurie Lowman	Radiological Affairs Support	Radiological Affairs Support Office, Naval Sea System Command Detachment	<ul style="list-style-type: none"> • Final approval of Licensing • Review, input, and approval of Work Plan and data, reports 	
Peter Stroganoff	ROICC San Francisco Bay Area	NAVFAC Southwest	Responsible for the Health and Safety and ongoing QC activities	
Nars Ancog	Navy QAO	NAVFAC Southwest	<ul style="list-style-type: none"> • Oversight of quality assurance (QA) issues for entire program • Review and approval of SAP, and all other QA/QC documents • Review of design process • Communication with Battelle QA Officer • Communication of issues to the Navy RPM • Authority to suspend work if quality criteria are not adequately being met 	

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Keith Fields	EMAC Program Manager	Battelle	<ul style="list-style-type: none"> • Chief program representative • Oversight of TO 0002 to ensure contract compliance • Control cost, schedule, and quality • Manage all program personnel, subcontractors, and resources • Support NAVFAC Southwest in stakeholder involvement and regulatory negotiations • Ensure compliance with all quality, environmental, health, safety, and security requirements 	
Eric Foote	Project Manager	Battelle	<ul style="list-style-type: none"> • Management of task order contract • Assignment of personnel • Monitoring and control of cost, schedule, and QC • Compliance with regulations • Management of subcontractors • Liaison with Contracting Officer/Contracting Officer's Representative (CO/COR) • Review of the project SSHP • Ensuring that the field personnel have received appropriate health and safety training for project work 	

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Betsy Cutié	QA Officer	Battelle	<ul style="list-style-type: none"> • Approval of QA/QC requirements • Review of data • Coordination of data validation • Interaction with Navy QAO 	
John Hardin	Site Health and Safety Officer	Battelle	<ul style="list-style-type: none"> • Primary contact for health and safety in the field • Monitor health and safety procedures during all field construction and operational activities • Conduct daily health and safety tailgate meetings and obtain signatures from attending personnel 	
John Hardin	Field Team Leader	Battelle	<ul style="list-style-type: none"> • Lead Battelle representative at the field site and primary interface between Project Manager, QA Officer, and field team including subcontractors • Provide critical analysis and interpretation of sediment data. • Ensure effective communication among project management team and all parties participating in field activities • Direct and coordinate all aspects of site work, including subcontractors and their efforts 	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role		Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Leonard Davis	Field Support	Radiological Handling and Safety	Battelle	<ul style="list-style-type: none"> Assist Field Team Leader with all responsibilities in field Performance of all sampling in accordance with the approved SAP Calibration and maintenance of field measurement equipment Completion of field documentation 	
Joe Jacobsen		Radiologic Sampling Lead			
John Eldridge		Radiologic Sampling Tech			
Scott Lowe		Sampling Tech			
Steve Maheras	Radiological Risk Expert/Coordinator		Battelle	<ul style="list-style-type: none"> Coordinate with Senior Radiological Risk Advisor during the DGI Work Plan development and with radiological field staff field support Participate in RAB and BCT meetings and project integration meetings with NFECSW, RASO and radiological support coordinator Support development of the FS Addendum 	
Bruce Napier	Senior Radiological Risk Advisor		Battelle (PNNL)	Provide expert consultation and input to the work plan, technical memorandum and FS Addendum	

SAP Worksheet #7 - Personnel Responsibilities and Qualification Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities	Education and Experience Qualifications (Optional)
Amoret Bunn	Radiological Ecological Risk Expert	Battelle (PNNL)	Support DGI Work Plan development and DGI Technical Memorandum and FS Addendum	
Craig Jones	Hydrodynamics and Sediment Transport Lead	Sea Engineering, Inc.	<ul style="list-style-type: none"> • Provide field services in the screening survey effort • Support DGI Work Plan development, DGI Technical Memorandum and FS Addendum 	
Steve Naber	Geospatial Statistician	Battelle	Support the development of a statistically defensible DGI Work Plan and DGI Technical Memorandum	
Patricia White	Site Characterization/ Sediment Transport Expert Consultant	CH2M Hill	<ul style="list-style-type: none"> • Support the development of a statistically defensible DGI Work Plan and DGI Technical Memorandum • Participate in RAB and BCT meetings 	
Bill Dougherty	Point of Contact for Analytical Services	Tetra Tech	Sample preparation and analysis	
Richard Amano	Point of Contact for Third Party Radiological Data Validation Services	Laboratory Data Consultants	Third-party data validation	

BCT – Base Closure Team

DGI – Data Gap Investigation

FS – Feasibility Study

NFECSSW – Naval Facilities Engineering Center Southwest

QA – quality assurance

QC – quality control

RAB – Remedial Action Board

RASO – Radiological Affairs Support Office

SAP – Sampling and Analysis Plan

SAP Worksheet #8 - Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Surface Supplied Air (SSA) Dive Team for Sampling of Drydock Structures	PADI Master Scuba Diver Certification (Dive Supervisors)	PADI Certified Instructor	Various training dates on file; all certifications are current	Dive Team	Dive Supervisors, Divers/ SEI Engineering, 2517 Blanding Ave., Alameda, CA	Sea Engineering Inc. Company Files
	PADI Scuba Diver Certification (Dive Team)	PADI Certified Instructor				
	Association of Diving Contractors (ADC)	Association of Diving Contractors International (ADCI)				
	Oxygen treatment	Private Training at SEI Alameda				
	OSHA Confined Space	Private training at SEI Alameda				

PADI: Professional Association of Diving Instructors

Field team members are trained in the routine field sampling procedures outlined in this plan. Specifically, field team members will have HAZWOPER 40 hour site worker training, one staff will have HAZWOPER Site Supervisor certification, and appropriate staff will be trained on Battelle Standard Operating Procedures (SOPs) for the following field activities: use of a Global Positioning System (GPS) for locating sampling points, sediment grab sample and core sample collection, sample handling, packaging, and shipping.

All personnel performing fieldwork will be provided with general awareness training for radiation. General awareness training provides the worker with a basic knowledge of the hazards, health concerns and protective practices related to radiation and radioactive materials. All personnel handling radioactive material under a Radioactive Material Application will be required to complete RAD-100 (Battelle, 2008).

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #9 - Project Scoping Sessions Participants Sheet

Table 9-1. Project Kick-Off Meeting

Project Name: Parcel F Radiological Data Gap Investigation Work Plan and Radiological Feasibility Study Addendum, Hunters Point Shipyard, San Francisco, California Projected Date(s) of Sampling: 3 Dec – 10 Dec 2008; 13 Apr – 15 May 2009 Project Manager: Eric Foote			Site Name: Parcel F, Hunters Point Shipyard Site Location: Former Hunters Point Naval Shipyard, San Francisco, CA		
Date of Session: September 3, 2008 Scoping Session Purpose: Kick-Off Meeting					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Dane Jensen	Remedial Project Manager	BRAC PMO West	619-532-0789	dane.c.jensen@navy.mil	RPM
Keith Forman	Base Environmental Coordinator	OASN (I&E) BRAC PMO West	619-532-0913	keith.s.forman@navy.mil	BEC
Laurie Lowman	Lead Environmental Protection Manager NAVSEADET RASO	SEA 04 04N	757-887-7650	laurie.lowman@navy.mil	RASO Lead
Patrick Owens	Environmental Program Manager (RASO)	SEA 04 04N	757-887-7644	patrick.a.owens@navy.mil	Environmental Program Manager
Bill Dougherty	Project Manager	Tetra Tech	415-671-2731	bill.dougherty@tteci.com	Radiation Laboratories Representative
Eric Foote	Project/Program Manager	Battelle	614-424-7939	foote@battelle.org	Project Manager
Keith Fields	Manager	Battelle	614-424-7723	fieldsk@battelle.org	EMAC Deputy Program Manager
Steve Maheras	Senior Research Scientist	Battelle	614-424-4563	maheras@battelle.org	Radiological Risk Expert/ Coordinator
Bruce Napier	Engineer	PNNL	509-375-3896	bruce.napier@pnl.gov	Senior Radiological Risk Advisor
Leonard Davis	Manager - Radiation Safety	Battelle	614-424-4368	davisl@battelle.org	Radiological Handling and Safety
John Hardin	Principal Research Scientist	Battelle	760-476-1415	hardinj@battelle.org	Field Team Leader

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

Table 9-1. Project Kick-Off Meeting (Continued)

Project Name: Parcel F Radiological Data Gap Investigation Work Plan and Radiological Feasibility Study Addendum, Hunters Point Shipyard, San Francisco, California Projected Date(s) of Sampling: 3 Dec – 10 Dec 2008; 13 Apr – 15 May 2009 Project Manager: Eric Foote			Site Name: Parcel F, Hunters Point Shipyard Site Location: Former Hunters Point Naval Shipyard, San Francisco, CA		
Date of Session: September 3, 2008 Scoping Session Purpose: Kick-Off Meeting					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Craig Jones	Physical Oceanographer	Sea Engineering Inc.	831-421-0871	cjones@seaengineering.com	Hydrodynamics and Sediment Transport Lead
Patty White	Risk Assessor	CH2M Hill	508-360-3214	patricia.white@ch2m.com	Site Characterization and Sediment Transport Expert Consultant
Leslie Lundgren	Manager	CH2M Hill	510-251-2426	Leslie.lundgren@ch2m.com	Site Consultant

NA = Not Available

Call Summary:

Project Scope and Goals

- Dane Jensen (RPM) presented a brief project history and provided information regarding the overall project scope and specific goals

Key Work Plan Development Items

- Eric Foote (Battelle) presented an overview of the project specific work elements as follows:
 1. Screening Survey – will be conducted to provide field data to aid in the development of the Data Gap Investigation (DGI) Work Plan
 2. DGI Work Plan
 3. Implementation of the DGI (Option 1 – awarded)
 4. Feasibility Study (FS) Radiological Addendum
- Eric Foote (Battelle) described the deliverables that are associated with these tasks:
 1. Sampling Plan, Radiological Sample Handling Plan and Health and Safety Plan (HASP) associated with the implementation of the Screening Survey (1 above)
 2. A DGI Work Plan (2 above) which will consist of a modified Sampling Plan, and Radiological Sample Handling Plan and HASP (if necessary)
 3. Technical Memorandum associated with the implementation of the DGI (3 above)
 4. FS Radiological Addendum (4 above)

Navy/Contractor Integration and Other Logistical Requirements

- Discussed Nuclear Regulatory Commission license issues:
 - Battelle must have a radioactive materials license reciprocity agreement with the California Department of Public Health
- Discussed initial data gathering event and on-site analysis capability
 - On-site analytical laboratory capabilities include: gamma spectroscopy, alpha spectroscopy, Sr-90 analysis, gross alpha-beta analysis
 - Can perform analysis for 20 samples per day gamma spectroscopy
 - 10% of samples analyzed for Sr-90
 - 10 day-2 week turnaround for sample results
 - Offsite samples would be coordinated by onsite lab point-of-contact for analytical services (Bill Dougherty – Tetra Tech, Inc.), 1 week-10 day turnaround
 - The Navy reiterated the need to understand the data before it is released; Navy must clear data for public release
- Battelle has the Navy's permission to contact Bill Dougherty (Tetra Tech EC Inc.) directly for results, cc: to Dane Jensen and Patrick Owens (Navy)

Risk and Dose Modeling

- There was brief discussion regarding the interest in risk and dose modeling for marine systems, acknowledging that this is an innovative area of risk assessment

Field Work

- When on-site, daily reports to the Navy and frequent communication are a requirement
- Surficial sediment samples collected during the Screening Survey will be screened for radiological constituents on deck of the vessel
- Sample disposition has not been determined. The Navy will clarify and this will be addressed again in the sample handling plan
- The decontamination procedures for sampling vessels were discussed. Sampling vessels do not anticipate the need to make landfall.
- Low level radioactive material will be transferred to the site radiological contractor. The Navy will clarify these levels

Training

- Bill Dougherty (Tetra Tech, Inc.) will be the contact for training
- HAZWOPER 40 – hour training and 8 – hour annual refresher training is mandatory for working on site

QA/QC Checks

- Eric Foote (Battelle) noted that Battelle has a dedicated Quality Assurance Officer (Elizabeth Cutié) for the EMAC Contract and she is intimately familiar with Navy QA/QC policies and works closely with Nars Ancog (Navy) on other programs.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

Future Meetings/Conference Calls

- It is anticipated that future meetings and conference calls will be schedule once per month on Wednesday at 1300 EDT

Schedule

- Battelle committed to having a draft version of the HASP, Radiological Sample Handling Plan and the Sampling Plan for the Screening Survey completed by the first week in October 2008.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

Table 9-2. Miscellaneous Telephone Conferences with Navy RPM

Project Name: Parcel F Radiological Data Gap Investigation Work Plan and Radiological Feasibility Study Addendum, Hunters Point Shipyard, San Francisco, California Projected Date(s) of Sampling: 3 Dec – 10 Dec 2008; 13 Apr – 15 May 2009 Project Manager: Eric Foote				Site Name: Parcel F, Hunters Point Shipyard Site Location: Former Hunters Point Naval Shipyard, San Francisco, CA	
Date of Session: September 30, 2008 Scoping Session Purpose: <u>Meeting at BRAC with Navy RPM</u>					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Dane Jensen	Remedial Project Manager	BRAC PMO West	619-532-0789	Dane.c.jensen@navy.mil	RPM
Keith Forman	Base Environmental Coordinator	OASN (I&E) BRAC PMO West	619-532-0913	Keith.S.Forman@navy.mil	BEC
Eric Foote	Project/Program Manager	Battelle	614-424-7939	foote@battelle.org	Project Manager
John Hardin	Principal Research Scientist	Battelle	760-476-1415	hardinj@battelle.org	Field Team Leader

Project Scope and Goals

- Dane Jensen (RPM) and Keith Forman provided information on:
 1. Site history (additional information to augment previous discussions).
 2. The need to sample within three drydock intake structures.
 3. Briefly discussed the regulatory agencies that would be involved.
 4. Review of the necessary meetings
- Eric Foote (Battelle PM) provided:
 1. Draft Project Schedule
 2. Additional information on the Project Team

Key Work Plan Development Items

- The group reviewed the schedule and made edits and changes
- Acknowledged that more meetings were required for the project
- Determined the length of the contract would need to be extended to cover document review requirements.

SAP Worksheet #10 - Problem Definition

General radioactive material (G-RAM) was used at Hunters Point Shipyard (HPS) since the mid-1940s and throughout its occupation by the Navy. Some of the G-RAM was released into the environment, and while extensive delineation studies and remediation have been conducted on land, very little data have been collected in the bay environment of Parcel F. An overview of HPS and the surrounding area in San Francisco Bay is provided in Figure 10-1.

Historical use of radionuclides at HPS has created a ‘reason to believe’ that unacceptable concentrations of radionuclides may be present in offshore sediments within Parcel F. Minimal historical data exists, and are insufficient to support future decisions regarding site closure or remediation. These data gaps need to be filled prior to making future decisions regarding site closure or remediation.

The following sites are of primary concern due to historical operational information:

- Drydocks # 2, 3, 4, 5, 6, & 7
- Intake and discharge systems for the Drydocks
- Adjacent to the Gun Mole Pier
- Southeastern nearshore area of South Basin

Of secondary concern are:

- All piers and berths
- Cobalt-60 in Northwestern nearshore area of South Basin

Due to the long period of time (since the 1940s) and the variety of radionuclide uses and sources, a general screening survey will be completed first. The screening survey will consist of sediment collected from the entire Parcel, not just the areas of primary concern.

Currently, it is unclear which radionuclides are present in sediments within Parcel F, and whether the concentrations pose a potential risk to human health and the environment.

As part of the Defense BRAC program, Parcel F at HPS requires a Radiological Data Gap Investigation with accompanying report and a Radiological Contamination Assessment Addendum to the FS.

There are two historical studies with a minimum amount of information for Parcel F (U.S. EPA 1989 and NWT 2002). Information from these two studies and a comprehensive report of radiological activities and contamination at HPS are provided in the Historical Radiological Assessment (US Navy, 1999; US Navy 2004).

To address the needs of transferring the Parcel F property to the public, Parcel F Base Closure Team discussions have recommended conducting a DGI, preparing a Radiological DGI Report, and completing a Radiological Addendum to the FS. The Radiological Addendum to the FS will screen for the human health and ecological risks and dose concerns posed by the Radiological DGI findings, determine if and where remedial options need to be developed for radiological contamination, and outline, analyze, and compare available remediation options.

Areas of primary concern in Parcel F (derived from the HRA) are shown in Figure 10-2. However, because of sufficient uncertainty about the nature and extent of the radionuclide levels within Parcel F, a two phased approach has been developed by Battelle to maximize the confidence of the data

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

evaluation provided in the Parcel F FS Radiological Addendum. The first phase is a screening study to provide an initial broad based screen of the Parcel sediments. Information from this screen will be used to design a more comprehensive DGI by focusing the DGI efforts on further defining the nature and extent of radionuclide contamination adjacent to any areas that indicate elevated levels from the screening study. This focused DGI will provide a strong scientific foundation for the FS Addendum and any necessary remedial actions. This study is compliant with recommendations from the HRA Volume I (US Navy, 1999) for conducting scoping surveys, characterization surveys, and final status surveys for Parcel F.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

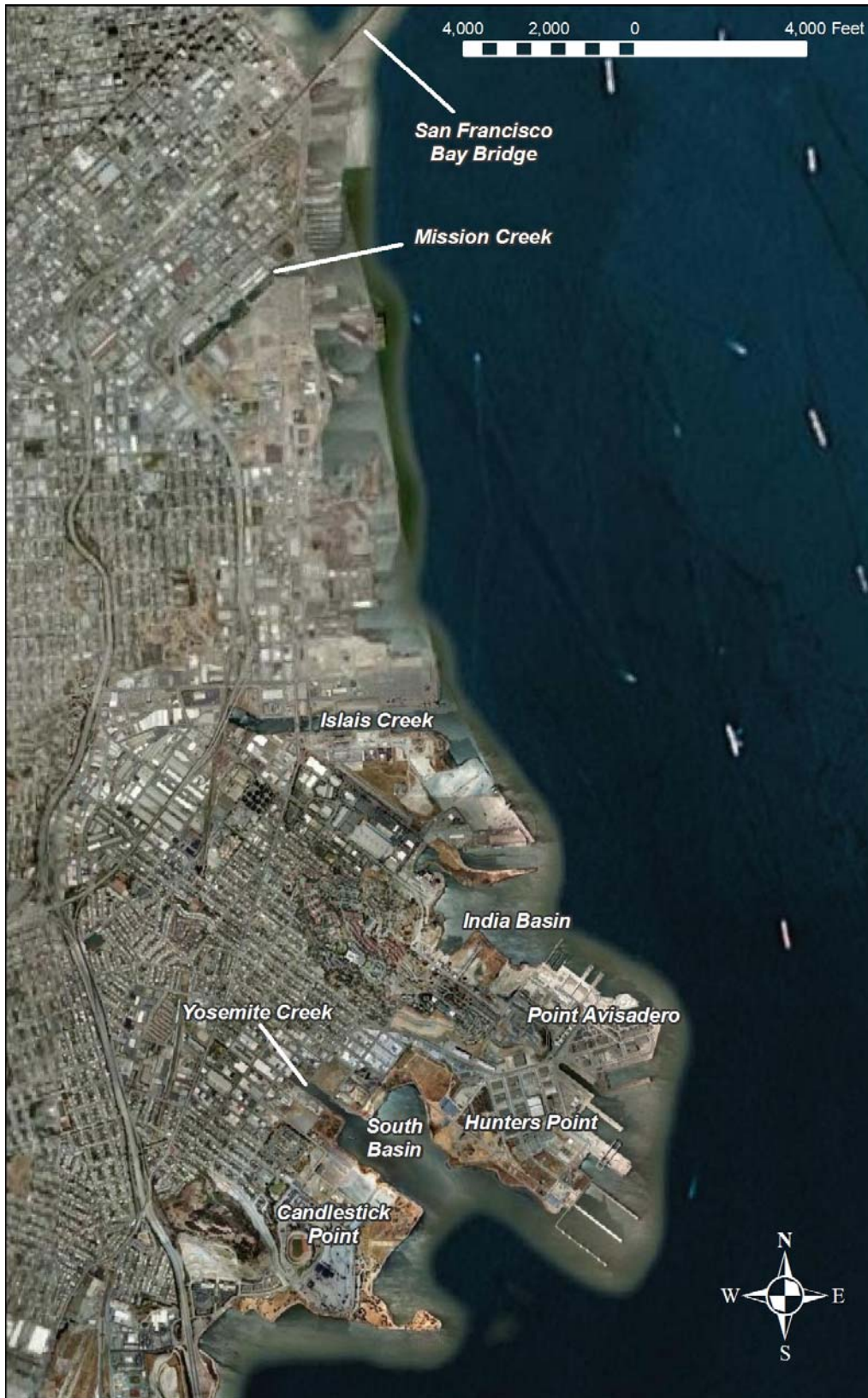


Figure 10-1. Study Site Overview

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

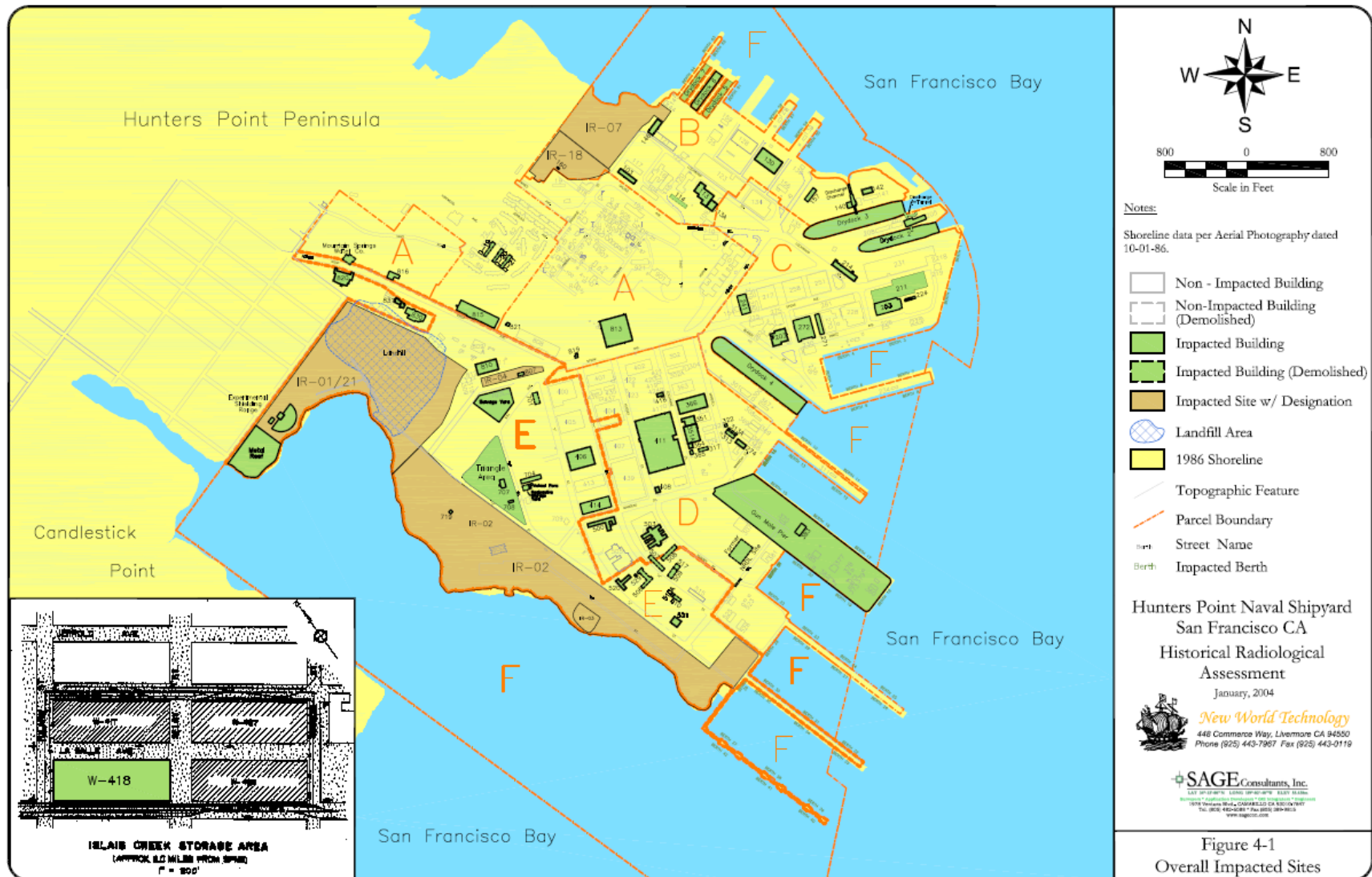


Figure 10-2. Impacted Sites as Reported in the HRA (Source: U.S. Navy, 2004)

SAP Worksheet #10 - Problem Definition (continued)

Study Overview

The primary objectives of the study are to collect data on the nature and extent of radionuclide levels within Parcel F to support future decisions regarding remediation or site closure at Parcel F. The specific objectives of this study are as follows:

- Phase I: Screening
 - Sediment will be the primary matrix
 - Sediment is relatively stable in time and space compared to water and organisms
 - Sediment is much less subject to dilution compared to water
 - Sediment is relevant due to its importance at the base of the food web, providing an entry point into the web from benthic organisms
 - Fifty surface sediment samples will be collected from areas of known concern and from representative locations throughout Parcel F.
 - Radionuclide levels will be measured in sediment samples collected.
 - Approximately fifty samples will be analyzed at the laboratory; more may be analyzed in the field in response to real-time measurements of samples on the vessel.
 - The Navy contractor TetraTech will analyze samples at HPS by utilizing New World Technology Inc. (NWT) and at Test America
 - (Tentative) Survey suction structures for drydocks 2, 3, and 4 in the Berths North area using divers. Pumping systems were operated from building 205 for drydock 2 and building 140 for drydock 3. No buildings were used for the drydock 4 suction and discharge systems.
 - Collect 3 to 5 sediment samples from each structure with diver cores or scoops into jars
 - Radionuclide levels will be measured in sediment samples collected.
 - The Navy contractor TetraTech will analyze samples at HPS by utilizing NWT and Test America
 - Data from this screening phase will be used to build the Phase II DGI
 - Data from the screening phase will be scientifically defensible and also available for use in the Phase II DGI
- Phase II: Data Gap Investigation
 - Sample locations and sampling methods will be determined after review of the screening survey and will be included in the SAP by amendment
 - Samples may be a combination of surficial sediments and cores
 - Sample analyses, will be determined after review of the screening survey results and will be included in the SAP by amendment. Potential measurements include:
 - Quantification of ROC in sediments
 - Age dating in cores to estimate sedimentation rates
 - Sedflume analyses to estimate sediment erosion potential
 - Water column velocity measurements for input into sediment transport risk assessment models
 - Data from historical sampling, the screening study, and the DGI will be incorporated into the human health and ecological risk assessments, the procedures which will be included in the SAP by amendment

Site Background

The Historical Radiation Assessment for Hunters Point (US Navy, 2004) provides a very comprehensive history of operations involving radionuclides at HPS. Attachment A provides a synopsis of information derived from the HRA that applies to Parcel F.

HPS is situated on a peninsula in the southeastern corner of San Francisco, CA. The peninsula is bounded on the north, east, and south by San Francisco Bay and on the west by the Bayview Hunters Point district. HPS comprises approximately 955 acres, with approximately 400 acres of offshore sediments. From 1945 to 1974, the Navy used HPS predominantly for ship repair and maintenance. In 1951, HPS shifted from operating as a general repair facility to specializing in submarine maintenance and repair. However, the Navy continued to operate Pacific Fleet carrier overhaul and ship maintenance repair facilities at HPS through the 1960s. Use of the shipyard began to decline steadily in the late 1960s and early 1970s because the Navy began using private shipyards to do work it had normally done in its own yards. As more work went to private yards, the primary mission of HPS continued on a diminishing basis until 1974 when the yard was disestablished as an active naval facility.

After HPS was deactivated in 1974 it remained relatively unused until 1976, when it was leased to Triple A Machine Shop, a private ship repair company. In 1986, the Navy resumed occupancy of HPS. The Base was closed in 1991. This study is being performed to address data gaps that exist in the quantification of the nature and extent of radioactive contamination within the offshore sediments of Parcel F.

Beneficial Uses at Parcel F

The San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan; SFRWQCB 2007) provides guidance and definitions on the beneficial uses within San Francisco Bay. The Navy will consider the substantive provisions of the Basin Plan, as it relates to surface water, including beneficial use, water quality objectives, and waste discharge requirements for potential applicable or relevant and appropriate requirement (ARAR) status.

Meteorology and Climate

Hunters Point has a maritime climate consisting of mild summers and winters. The majority of the precipitation that occurs in the San Francisco Bay area occurs between October and April. The average annual rainfall in the San Francisco Bay area is approximately 20 to 22 in (National Oceanic and Atmospheric Administration [NOAA], 2005). At the site, precipitation either returns to the atmosphere via evapotranspiration, runs off into San Francisco Bay, or infiltrates into the subsurface and groundwater underlying the site.

The daily high temperature generally averages approximately 60°F from November through April and approximately 70°F from May through October. The annual median daily high temperature is approximately 65°F. Freezing temperatures are generally never experienced, and frozen precipitation is exceedingly rare. Based on measurements from a monitoring station in Alameda, San Francisco Bay surface water temperatures are on average in the low 50°F range during the winter months and the mid 60°F range during the summer months. The dominant wind direction in the Oakland area is from the west or west northwest, with average annual wind speeds of approximately 7 to 7.5 miles per hour (mph). Wind speeds typically are greatest in the late spring and summer months, and lowest in winter months.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

Land Use

Currently, the use plans for land adjacent to Parcel F, and the aquatic environment within Parcel F, are not finalized. Land/aquatic use restrictions may be applied to the property and included in findings of suitability to transfer, findings of suitability for early transfer, “Covenant(s) to Restrict Use of Property” between the Navy and DTSC, and any Quitclaim Deed(s) conveying real property containing Parcel F at HPS.

SAP Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements

U.S. EPA's seven-step data quality objective (DQO) process was used during the planning stages for this project. The DQOs are presented in Table 11-1.

To complete the U.S. EPA's seven-step DQO process, the following critical questions were answered:

Who will use the data? The data will be used by the Project Team, the data validator, the Navy RPM, California DTSC, California State Water Board, U.S. EPA, CalEPA, RAB, and the City of San Francisco to determine if the data are suitable for the intended use and if further response or remedial action is necessary prior to site closures.

What are the Project Action Limits? Action levels for radionuclides in sediment are currently conservative values for the screening survey based on the site land reuse values. These limits will need to be refined during the DGI for submerged marine sediment with very limited avenues for contact compared to soils and refined for potential exposure pathways. Action levels selected as project action limits (PALs) for the radionuclides are provided in Worksheet #s 15.

What will the data be used for? The data will be used to answer the following questions:

Are radionuclides currently present in sediment within Parcel F?

What further action will be necessary to define the nature and extent of radionuclide concentrations in Parcel F Sediments to assess the threat to human health or the environment, or determine that site closure with no further action is appropriate?

What types of data are needed? Sediment samples will be analyzed at onsite and quality control (QC) will be provided at off-site laboratories for radionuclides. The specific target analytes can be found on Worksheet #15.

How "good" do the data need to be in order to support the environmental decision? Worksheet #37 describes the usability assessment of the data.

How much data should be collected? Worksheet #17, Table 17-1 describes the number and location of samples required for the HPS Parcel F Study.

Where, when, and how should the data be collected? Sediment samples will be collected from the sites of concern and at sites to address spatial coverage (as seen in Table 17-1). Figures 17-1 through 17-5 show the locations where samples will be collected. The sediment samples will be collected following the standard operating procedures (SOPs) included in Attachment B. Samples will be collected once the plans have been approved by all stakeholders.

Who will collect and generate the data? Battelle will collect the sediment samples with support from our subcontractor Sea Engineering, Inc. (SEI). Samples will be hand delivered to the onsite radiological laboratory operated by NWT. NWT will subsample and ship approximately 10% of the samples to an off-site laboratory for Quality Control.

How will the data be reported? Data will be incorporated into tables, graphics, or other visual representations. The data will be incorporated into an Addendum to the existing FS report for Parcel F.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

How will the data be archived? All data including field observations, field audits, and analytical data (both hard copy and electronic copy) will be stored at Battelle's Records Management office in a fire-safe environment. The data will be kept on file for 7 years or longer if requested.

Table 11-1. Project Quality Objectives

STEP 1 State the Problem	STEP 2 Identify the Goals of the Screening Study	STEP 3 Identify Information Inputs	STEP 4 Define the Boundaries of the Study	STEP 5 Develop the Analytic Approach	STEP 6 Specify Performance or Acceptance Criteria	STEP 7 Develop the Plan for Obtaining the Data
<p>Historical use of radionuclides at HPS has created a ‘reason to believe’ that unacceptable concentrations of radionuclides may be present in offshore sediments within Parcel F and drydock pumping structures located underground in Parcel B. Minimal historical radionuclide data exists, and are insufficient to support future decisions regarding site closure or remediation. These data gaps need to be filled prior to making future decisions regarding site closure or remediation.</p> <p>The following sites are of primary concern due to historical operational information:</p> <ul style="list-style-type: none">• Drydocks # 2,3,4,5,6,&7• Intake and discharge systems for the Drydocks• Adjacent to the Gun Mole Pier• Southeastern nearshore area of South Basin <p>Of secondary concern are:</p> <ul style="list-style-type: none">• All piers and berths• Cobalt-60 in Northwestern nearshore area of South Basin <p>Due to the long period of time (since the 1940s) and the variety of radionuclide uses and sources, a general screening survey will be completed first. The screening survey will consist of sediment collected from the entire Parcel, not just the areas of primary concern.</p> <p>Currently, it is unclear which radionuclides are present in sediments within Parcel F, and whether the concentrations pose a potential risk to human health and the environment.</p>	<p>Q1. Is further action necessary to address radionuclide concentrations in Parcel F sediments that may pose a threat to human health or the environment or is site closure with no further action appropriate?</p>	<p>For the screening survey, approximately 2/3 of the sediment samples will be collected from the primary areas of concern and 1/3 of the location will be distributed throughout Parcel F to investigate the possibility that undocumented disposal or movement of material has occurred. Samples will be collected with routine grab and piston core methods.</p> <p>Sediment samples will be analyzed for radionuclides: Co-60, Cs-137, Ra-226, Pu-239, Sr-90, and U-235.</p> <p>In addition to the data generated from the proposed sampling discussed above, historical results from previous studies will also be included in the screening survey evaluation and DGI study design.</p>	<p>The lateral boundaries of the study are the boundaries of Parcel F (from the mean low tide line to the offshore boundary of the parcel). In a conservative approach, where piers extend beyond the Parcel F boundary, areas adjacent to those piers will also be studied.</p> <p>The vertical boundary of the screening investigative activities is a depth of three feet. The three foot depth is expected to be deep enough to sample below the 1940’s sediments (and thus encompass sediment from known radiological activities at HPS) based on known and expected sedimentation rates within Parcel F. Where refusal in sampling occurs, it is inferred that the sediments below refusal are native material not from relatively recent deposition (<75 years) and not suspected to contain ROCs. In addition, in areas such as the Dry Docks and suction structures, the layer of sediment on the bottom of the concrete and/or steel structures is expected to be relatively thin (0-6”).</p> <p>Figures 17-1 through 17-5 show proposed sampling locations in each of the areas at Parcel F, the shoreline and offshore boundaries of Parcel F, and buildings with historical radiological activities at HPS.</p> <p>There are no temporal boundaries for this study.</p>	<p>DR1. Sediment samples collected for radiological analysis will be evaluated as follows:</p> <ul style="list-style-type: none">• If the concentrations of radionuclides in sediment are less than the respective Project Action Limits (see Worksheet #15), then it will be determined that no further action is required in the area represented by the sample.• If the concentrations of radionuclides in sediment exceed the Project Action Limits (see Worksheet #15), then it will be determined that further action may be necessary; the full scope and objectives of the work will be discussed in detail between the Navy and regulatory agencies. Further action will be recommended as part of the second phase of the study, the DGI, and will be included in the SAP by amendment.	<p>Decision errors include data quality and usability. To ensure the quality of the data, all data will be reviewed, verified, and validated in accordance with the SAP. To ensure usability of laboratory data, appropriate laboratory methods have been selected to provide the necessary laboratory detection limits.</p> <p>Acceptance criteria for the analytical data are listed in Worksheet #28</p>	<p>The sampling design is described in Worksheet #17 The sampling design includes the following elements:</p> <p>Grab samples and/or piston core methods will be used for collecting sediment samples at:</p> <ul style="list-style-type: none">• Drydocks # 2,3,4,5,6,&7• Adjacent to the Gun Mole Pier• Southeastern nearshore area of South Basin• All piers and berths• Cobalt-60 in Northwestern nearshore area of South Basin <p>SCUBA diving sampling methods will be used to collect sediment at:</p> <ul style="list-style-type: none">• Intake pump systems 2 and 4. <p>The proposed sampling locations are based on best professional judgment and site history. Two thirds of the sites were selected because these sites are expected to have the highest concentrations within the area, or provide the most valuable data (e.g., sediment downstream from the site drainage system from a known source area). One third of the sample sites are distributed throughout the berthing areas to confirm that the site history is correct, and insignificant radionuclide disposal has occurred in the area.</p> <p>Therefore, the proposed screening survey sampling scheme represents a resource-efficient design.</p>

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #12 - Measurement Performance Criteria Table – Sediment

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Field Duplicate	Radionuclides	10% of field samples	Precision	Not applicable for sediment samples	S & A
Matrix Spike and Matrix Spike Duplicate	Radionuclides	1 per batch of 20 samples	Precision/Accuracy	Measurement performance criteria are listed in Worksheet 28, table 28-1	A
Equipment Rinsate	Radionuclides	1 per sampling day	Accuracy/Bias	Evaluate sample results against analytes present in blank to determine impact on sample results	S & A
Source Blank	Radionuclides	1 per source of decontamination water	Accuracy/Bias	Source blank samples should not contain radionuclides greater than the reporting limit	S & A

Note: Field duplicate samples are not collected for sediment due the inherent variability of the sediment matrix

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #13 - Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Historical Radiological Assessment at Hunters Point Annex. (Volume 1)	Naval Sea Systems Command (NAVSEA) - Radiological Control Office Pearl Harbor Naval Shipyard & Intermediate Maintenance Facility, Pearl Harbor, HI Historical Radiological Assessment. Hunters Point Annex Volume 1 Naval Nuclear Propulsion Program January 1999	US Navy in response to CERCLA requirements. Review of site history and historical data regarding the Navy Nuclear Propulsion Program	Help develop sampling approach and design (e.g., identify areas of primary concern and target radionuclides).	None
Historical Radiological Assessment. Volume II. Describes the history of operations involving general radioactive material (G-RAM) at Hunters Point Shipyard	NAVSEA - Radiological Affairs Support Office. Follows Historical Site Assessment methods established by MARSSIM. Historical Radiological Assessment. History of the Use of General Radioactive Materials 1939 - 2003 Hunters Point Shipyard Volume II	US Navy pursuant to the Navy's Installation Restoration (IR) Program, which encompasses the Base Realignment and Closure (BRAC) Program. In accordance with the CERCLA and SARA.	Help develop sampling approach and design (e.g., identify areas of primary concern and target radionuclides).	None
U.S. EPA study of radionuclide levels in Parcel F at Hunters Point Shipyard.	U.S. EPA Region 9, Radiological Survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard. March 1989 (HRA-2951)	U.S. EPA Region 9. Collected water, sediment, and biota samples from 21 locations in Parcel F at HPS. Samples collected in September 1986. Analysis focused on gamma emitters (esp. Co60) and Tritium (in water).	Support weight of evidence during data evaluation.	Data have less sensitive detection limits and fewer isotopes compared to specifications proposed in this SAP.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #13 - Secondary Data Criteria and Limitations Table (Continued)

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Radiological assessment of structures at HPS berths within Parcel F at Hunters Point Shipyard.	New World Technologies (NWT) Phase V investigations of Berths 15, 16, 17, 18, 19, and 20 at Gun Mole Pier. 2002	NWT, radionuclide data on structures.	To support weight of evidence during data evaluation	None
Parcel F Validation Study	Battelle for BRAC. Hunters Point Shipyard Parcel F Validation Study Report. 2005	Battelle and subcontractors collected surface sediment, sediment cores, invertebrates, and fish. 59 locations sampled in Parcel F. May 2001 and October 2003	Physical properties of sediments, potential covariance of radionuclides with contaminants and physical properties. Maps and figures.	None
Parcel Feasibility Study	Barajas & Associates, Inc. for BRAC. Feasibility Study Report for Parcel F Hunters Point Shipyard San Francisco, California. 2008	Barajas & Associates, Inc. and subcontractors. Summarizes data from six surveys from 1991 to 2003 in a Feasibility Study format.	Physical properties of sediments, potential covariance of radionuclides with contaminants and physical properties. Maps and figures.	None

SAP Worksheet #14 - Summary of Project Tasks

The project is broken down into three primary tasks:

1. Screening Survey
2. Data Gap Investigation
3. Radiological Addendum to FS

Project tasks associated with the tasks are as follows:

Screening Survey:

- Sediment sampling
- Field documentation of all sampling
- Analysis of samples for radionuclides
 - In the field using field meters
 - At onsite laboratory
 - At offsite laboratory
- Data transfer from laboratory to Battelle
- Audit/Assessment for QC of sampling and analytical methods
- Third party data validation
- Data reduction, analysis, interpretation
- Data storage and archiving

DGI:

- Prepare the amendment to the sampling plan
- Field sampling
- Field documentation of all sampling
- Analysis of samples for radionuclides
 - In the field using field meters
 - At onsite laboratory
 - At offsite laboratory
- Analysis of other matrices/parameters as specified in DGI sampling plan amendment
- Data transfer from laboratory to Battelle
- Audit/Assessment for QC of sampling and analytical methods
- Third party data validation
- Minimal data reduction, analysis, interpretation
- Produce Technical Memorandum (summary of data)
- Data storage and archiving
- FS Radiological Addendum

SAP Worksheet #14 - Summary of Project Tasks (Continued)

Major tasks associated with the sampling effort will include the following:

Screening Survey Sampling Tasks

Sampling of sediment for radionuclides (Co-60, Cs-137, Ra-226, Pu-239, Sr-90, and U-235) will be conducted at 50 sites in Parcel F. Sediment samples will be collected with either a surface grab sampler (e.g., Van Veen) or a piston core sampler. Swipe samples will be analyzed for radiation (alpha and gamma) with a portable meter on the ship by Battelle staff. Samples will be analyzed for radionuclides at NWT, the onsite laboratory and 10% of the samples will be analyzed at Test America. See Worksheet #17 for sampling design and rationale at each site. Tentatively scheduled are surveys of the drydock suction structures in the Berths North Area at drydocks #2, and #3, and #4. The suction structures at Drydocks #2 and #3 are associated with Buildings 205 and 104, respectively. There is no building associated with the suction structure at Drydock #4. Divers will collect 3 to 5 sediment samples from each structure using either a diver core or scoop and jar. Samples will be analyzed in the same manner as the open water sediment samples. See Worksheet #18 for specific samples to be collected and their respective locations.

Screening Survey Post-Sampling Field Tasks

Equipment decontamination, investigation-derived waste (IDW) characterization and disposal, and surveying tasks will be performed. Navy Radiological Affairs Support Office (RASO) staff will oversee the radiation decontamination process. See Worksheet #17 for details and SOPs for post-sampling field tasks. Also, proper delivery and chain-of-custody documentation of samples will be completed. See Worksheets #26 and #27 for sample handling system and custody requirements.

Screening Survey Analytical Tasks

Sediment samples will be analyzed at NWT, the onsite radiological laboratory and 10% of the samples will be analyzed at Test America. See Worksheet #23 for specific laboratory analysis methods.

Screening Survey Quality Control Tasks

All analytical methods will require the applicable QC tasks described in the respective methods, including initial calibrations, continuing calibrations, tuning, reagent blanks, surrogates, replicates, control spikes, and others as necessary. Media-specific field quality control samples including source water blanks, equipment rinsate samples, trip blanks, and field duplicates will be used to measure total process performance. Ten percent of the onsite laboratory samples will be sent to Test America for analysis. See Worksheets #24 and #25 for instrument calibration and maintenance as well as Worksheet #28 for laboratory QC samples and criteria.

Screening Survey Data Management and Review Tasks

Analytical data generated by the fixed laboratory will be reviewed by the laboratory using three levels of document review and reporting. Reviews will be documented using appropriate checklists forms, or logbooks, that will be signed and dated by the reviewer. See Worksheet #31 for planned project assessment reports, Worksheet #33 for QA management, and Worksheets #34, #35, and #36 for verification and validation procedures.

SAP Worksheet #14 - Summary of Project Tasks (Continued)

Screening Survey Third Party Data Validation

Data review and validation will also be performed by a third-party data validation service. The data will be validated at 80% U.S. EPA Level III and 20% U.S. EPA Level IV.

DGI Survey Pre-sampling Tasks

Because of the uncertainty regarding the nature and extent of the radionuclide levels within Parcel F, a two phased approach has been developed by Battelle. The first phase is a screening survey encompassing all areas of Parcel F that will provide information to design a focused, comprehensive DGI. A focused DGI will provide a strong scientific foundation for the FS Addendum and any necessary remedial actions. An addendum to the SAP will be prepared for the DGI that encompasses the screening results and satisfies the requirements of the FS Addendum.

DGI Survey Sampling Tasks

Sampling of matrices and parameters as described and defined in the DGI sampling plan amendment.

DGI Survey Post-Sampling Field Tasks

Equipment decontamination, IDW characterization and disposal, and surveying tasks will be performed. Navy RASO staff will oversee the radiation decontamination process. Worksheet #17 will be updated with details and SOPs for post-sampling field tasks. Proper delivery and chain-of-custody documentation of samples will be updated as required, and Worksheets #26 and #27 for sample handling system and custody requirements will be updated as required.

DGI Survey Analytical Tasks

Sediment samples will be analyzed onsite at NWT, the onsite radiological laboratory and 10% of the samples will be analyzed at Test America. Updated information regarding the DGI will be provided for all applicable Worksheets in the SAP amendment.

DGI Survey Quality Control Tasks

All analytical methods will require the applicable QC tasks described in the respective methods, including initial calibrations, continuing calibrations, tuning, reagent blanks, surrogates, replicates, control spikes, and others as necessary. Media-specific field quality control samples including source water blanks, equipment rinsate samples and field duplicates will be used to measure total process performance. Ten percent of the onsite laboratory samples will be sent to Test America for analysis. Updated information regarding the DGI will be provided for all applicable Worksheets in the SAP amendment.

DGI Survey Data Management and Review Tasks

Analytical data generated by the fixed laboratory will be reviewed by the laboratory using three levels of document review and reporting. Reviews will be documented using appropriate checklists forms, or

logbooks, that will be signed and dated by the reviewer. Updated information regarding the DGI will be provided for all applicable Worksheets in the SAP amendment.

DGI Survey Third Party Data Validation

Data review and validation will also be performed by a third-party data validation service. The data will be validated at 80% U.S. EPA Level III and 20% U.S. EPA Level IV.

Procedures for data recording, management, auditing, and correction will include the following:

Field Documentation

A project-specific field logbook will be used to provide daily records of significant events, observations, and measurements during field investigations. The field logbook also will be used to document all sampling activities. All logbook entries will be made with indelible ink to provide a permanent record. Logbooks will be kept in the possession of the field team leader during the on-site work and all members of the field team will have access to the notebook. The notebook(s) will be maintained as permanent records. Any errors found in the logbook will be verified, crossed-through, and initialed by the person discovering the error.

The field logbook(s) are intended to provide sufficient data and observational information to reconstruct events that occurred during field activities. Field logbooks will be permanently bound and pre-paginated; the use of designated forms should be used whenever possible to ensure that field records are complete. The following items are examples of information that may be included in a field logbook:

- Name, date, and time of entry
- Names and responsibilities of field crew members
- Name and titles of any site visitors
- Descriptions of field procedures, and problems encountered
- Number and amount of samples taken at each location
- Details of sampling location, including sampling coordinates
- Sample identification numbers of all samples collected
- Date and time of collection
- Sample collector
- Sample collection method
- Decontamination procedures
- Field instrument calibration and maintenance
- Field measurements (e.g., gamma radiation, sample depth, etc.) and general observations.

Data Transfer and Transmittal

NWT, the onsite radiological laboratory, will summarize and evaluate the analytical results in laboratory reports, report results of field and laboratory QC samples (including any samples sent to Test America), and provide a quality control summary report. Field data, including field notes copied from bound field logbooks or other media, field forms, and field analysis results will be presented in the report.

For samples collected and analyzed as part of this project, analytical results are required to be delivered in both hardcopy and electronic data deliverable (EDD) formats. An automated laboratory information management system (LIMS) must be used to produce the electronic copy. Manual generation of the

electronic file (data entry by hand) is unacceptable. The laboratory will verify the electronic data files internally before they are issued. The electronic data will correspond exactly to the hard-copy data.

Data will be delivered in a format compatible with Navy EDD, or applicable standards as requested.

Assessment/Audit Tasks

During project activities, ongoing assessments will include peer review, quality control reviews, audits of field operations, checks to see that project personnel have read appropriate planning documents and are following documented procedures, and reviews to ensure that clearance activities and preliminary work have been satisfactorily completed. A field audit will be performed once during the sampling event and documented on the Field Sampling Checklist (Attachment #14-1). Laboratory audits are not scheduled to occur in conjunction with this project. The Navy QAO may audit any part of the task, including the laboratory, at any time at its discretion. See Worksheets #31 through #36 for assessment and audit procedures.

Data Review Tasks

All analytical data generated by subcontract laboratories in support of this project will be reviewed internally by the laboratory prior to reporting, to assure the validity of reported data. This internal laboratory process will consist of data reduction and three levels of document review. The project manager will compare the generated data with project goals and objectives to ensure project DQOs can be met by the data. Data review and validation will also be performed by a third-party data validation service.

Data transfer to NIRIS

Analytical and field data will be uploaded to the Naval Installation Restoration Information Solution (NIRIS) system within 30 days of receipt of the final data validation report.

Data storage, archiving, retrieval, and security will be managed as follows:

Data will be submitted electronically to the NIRIS in Navy EDD format. Battelle will maintain electronic copies of all sampling forms, chain-of-custody forms, and all Navy EDD. All field data, field notes, analytical reports, etc., will be stored in hardcopy and/or electronic format by Battelle in a central project file for the period specified in the contract. Battelle will also store the data electronically in project files on our main server, which is backed up on magnetic tape for long-term storage.

All relevant analytical raw data and documentation, including (but not limited to) logbooks, data sheets, electronic files, and final reports, will be maintained by the laboratories for at least five years.

In conformance with Environmental Work Instruction (EWI) #4 from NAVFAC the hard copy of the analytical data will be delivered to the Navy's Administrative Record Department upon submittal of the final report. Data will be archived at Battelle until delivery to the Navy's Administrative Records Department.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Attachment #14-1: Field Checklist

Battelle Field Sampling Checklist

Site Name: Hunters Point - Parcel F

Date: _____

Checklist Completed by: _____

Reviewed by: _____

Signature

Date

Initials

Date

Samples in proper container/bottle?

Yes ☐

No ☐

Sample containers intact?

Yes ☐

No ☐

Sufficient sample volume?

Yes ☐

No ☐

Was an MS/MSD sample collected today?

Yes ☐

No ☐

Chain of custody (COC) agrees with sample labels?

Yes ☐

No ☐

Placed bagged ice in cooler?

NA ☐

Yes ☐

No ☐

Temperature blank in cooler?

Yes ☐

No ☐

COC signed when received and relinquished?

Yes ☐

No ☐

COC taped to the inside of cooler lid?

Yes ☐

No ☐

Checked that drain plug is taped over and taped up cooler?

Yes ☐

No ☐

Filled out Fed Ex Form and attached to cooler?
(Retain copy for records and tracking)

NA ☐

Yes ☐

No ☐

Notified Lab of # of coolers and # samples and tracking #?

Yes ☐

No ☐

Number of Samples Collected today: _____

Number of QA Samples Collected Today: _____

Document any modifications to sampling SOP or problems that occurred:

POC:	Role	Phone Number:
Eric Foote	Project Manager	614-424-7939 or cell 614-374-2729
John Hardin	Field Team Leader	760-476-1415 or cell 760.310.5679
Bill Dougherty	TtEC POC	415-671-1990

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Sediment
Analytical Group: Radionuclides

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference ^(a)	Project QLs/MDAs (pCi/g) ^(b)	Analytical Method MDLs (pCi/g) ^(b)	Analytical Method QLs/MDAs (pCi/g) ^(b)
Gamma-emitting isotopes						
Radium-226 (On-site Laboratory)	13982-63-3	1.0 above background	Final HPS RA Memorandum (Tetra Tech, 2006)	N/A	1.4	N/A
Radium-226 (Off-site Laboratory)	13982-63-3	1.0 above background		N/A	0.7	N/A
Cesium-137	10045-97-3	0.113		N/A	0.07	N/A
Cobalt-60	10198-40-0	0.0361		N/A	0.02	N/A
Uranium-235	15117-96-1	0.195		N/A	0.1	N/A
Sr-90						
Strontium-90	10098-97-2	0.331	Final HPS RA Memorandum (Tetra Tech, 2006)	0.17	N/A	0.17
Alpha-emitting isotopes						
Plutonium-239	97918-67-7	2.59	Final HPS RA Memorandum (Tetra Tech, 2006)	1.29	N/A	1.29

- (a) Project action limits are derived from the Department of the Navy (DON). 2006. *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California*. The project action limits are for soil, thus relatively conservative in regards to sediment action limits. Limits will be addressed and revised during the DGI.
- (b) The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time. Values listed are from validated analytical methods.

QL: quantitation limit
MDA: minimal detective activity
MDL: method detection limit
pCi/g: picocurie per gram

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #16 - Project Schedule Timeline Table

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Initiation Date	Anticipated Completion Date		
Kick-Off Meeting	Battelle/Navy	September 3, 2008	September 3, 2008	None	None
Accident Prevention Plan, SSHP, Activity Hazard Analysis, Radioactive Materials Management Plan (Draft)	Battelle	September 3, 2008	October 2, 2008	Accident Prevention Plan, SSHP, Activity Hazard Analysis, Radioactive Materials Management Plan (Draft)	October 2, 2008
SAP (Draft)	Battelle	September 3, 2008	November 3, 2008	SAP (Draft)	November 12, 2008
Navy Review of Accident Prevention Plan, SSHP, Activity Hazard Analysis, Radioactive Materials Management Plan (Draft)	Navy	October 3, 2008	October 31, 2008	Navy Comments	October 31, 2008
Navy Review of SAP (Draft)	Navy	November 12, 2008	November 26, 2008	Navy Comments	QA/QC December 2, 2008 RASO December 10, 2008
Accident Prevention Plan, SSHP, Activity Hazard Analysis, Radioactive Materials Management Plan (Final)	Battelle	November 3, 2008	January 16, 2009	Accident Prevention Plan, SSHP, Activity Hazard Analysis, Radioactive Materials Management Plan (Final)	January 16, 2009
SAP (Draft)	Battelle	December 2, 2008	January 23, 2009	SAP (Draft)	January 23, 2009
RAB/BCT Meeting	Battelle/Navy	January 20, 2009	January 22, 2009	RAB/BCT Meeting Minutes	January 22, 2009
Implement Field Screening Event	Battelle	February 9, 2009	February 19, 2009	None	None
Process Results	Battelle	February 9, 2009	February 27, 2009	None	None
DGI Work Plan (Internal Draft)	Battelle	October 3, 2008	March 13, 2009	None	None

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #16 - Project Schedule Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Initiation Date	Anticipated Completion Date		
Navy Review of DGI Work Plan (Internal Draft)	Navy	March 16, 2009	March 27, 2009	Navy Comments	March 27, 2009
DGI Work Plan (Draft)	Battelle	March 30, 2009	April 10, 2009	DGI Work Plan (Draft)	April 10, 2009
Navy/Regulators Review of DGI Work Plan (Draft)	Navy/Regulators	April 13, 2009	May 13, 2009	Navy/Regulators Review of DGI Work Plan (Draft)	May 13, 2009
DGI Work Plan (Draft Final)	Battelle	May 14, 2009	May 29, 2009	DGI Work Plan (Draft Final)	May 29, 2009
Navy/Regulator Review of DGI (Draft Final)	Navy/Regulators	June 1, 2009	June 12, 2009	Navy/Regulator Review of DGI (Draft Final)	June 12, 2009
DGI Work Plan (Final)	Battelle	June 15, 2009	June 19, 2009	DGI Work Plan (Final)	June 19, 2009
Implement DGI	Battelle	June 22, 2009	July 10, 2009	None	None
Sample Analysis	Battelle	June 22, 2009	August 21, 2009	None	None
Data Processing	Battelle	June 22, 2009	August 21, 2009	None	None
RAB/BCT Meeting	Battelle/Navy	August 25, 2009	August 27, 2009	RAB/BCT Meeting Minutes	August 27, 2009
DGI Technical Memorandum (TM) (Internal Draft)	Battelle	July 13, 2009	September 11, 2009	DGI Technical Memorandum (TM) (Internal Draft)	September 11, 2009
Navy Review of TM (Internal Draft)	Navy	September 14, 2009	October 14, 2009	Navy Comments	October 14, 2009
DGI TM (Draft)	Battelle	October 15, 2009	October 30, 2009	DGI TM (Draft)	October 30, 2009
Navy/Regulators Review of TM (Draft)	Navy/Regulators	November 2, 2009	December 4, 2009	Navy/Regulators Comments	December 4, 2009
DGI TM (Draft Final)	Battelle	December 7, 2009	December 21, 2009	DGI TM (Draft Final)	December 21, 2009
Navy/Regulator Review of TM (Draft Final)	Navy/Regulators	December 22, 2009	January 12, 2010	Navy/Regulator Comments	January 12, 2010

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #16 - Project Schedule Timeline Table (Continued)

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Initiation Date	Anticipated Completion Date		
TM (Final)	Battelle	January 13, 2010	February 5, 2010	TM (Final)	February 5, 2010
FS Radiological Addendum (Internal Draft)	Battelle	December 7, 2009	February 5, 2010	FS Radiological Addendum (Internal Draft)	February 5, 2010
RAB/BCT Meeting	Battelle/Navy	January 26, 2010	January 28, 2010	RAB/BCT Meeting Minutes	January 28, 2010
Navy Review of FS Rad Addend. (Internal Draft)	Navy	February 8, 2010	March 10, 2010	Navy Comments	March 10, 2010
FS Rad Addend. (Draft)	Battelle	March 11, 2010	April 2, 2010	FS Rad Addend. (Draft)	April 2, 2010
Navy/Regulator Review of FS Rad. Addend. (Draft)	Navy/Regulators	April 5, 2010	May 20, 2010	Navy/Regulator Comments	May 20, 2010
FS Rad. Addend./RTC (Draft Final)	Battelle	May 21, 2010	June 18, 2010	FS Rad. Addend./RTC (Draft Final)	June 18, 2010
Navy/Regulator Review of FS Rad. Addend./RTC (Draft Final)	Navy/Regulators	June 21, 2010	July 22, 2010	Navy/Regulator Comments	July 22, 2010
FS Rad Addend. (Final)	Battelle	July 23, 2010	August 13, 2010	FS Rad Addend. (Final)	August 13, 2010
Navy/Regulator Review of FS Rad. Addend. (Final)	Navy/Regulators	August 16, 2010	August 27, 2010	Navy/Regulator Comments	August 27, 2010
FS Rad. Addend (Final)	Battelle	August 30, 2010	September 10, 2010	FS Rad. Addend (Final)	September 10, 2010

SAP Worksheet #17 - Sampling Design and Rationale

Based on the very limited amount of available historical data, a two phased sampling approach will be implemented. Phase one is a screening survey sampling to determine on a broad scale the nature and extent of radionuclide concentrations within Parcel F. The second survey, the DGI, will be performed to gather data to support an addendum to the Parcel F FS. The final design of the DGI will be based upon data collected and analyzed from the screening survey. This section presents a sampling approach for the screening survey, and the expected approach for the DGI. The DGI design is in outline form, and details will be provided in an upcoming addendum to this SAP. The main objective of the sampling efforts is to collect sufficient analytical data to quantify the range and extent of radionuclides of concern (ROC) (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235) in Parcel F sediments. The objective of the Amendment to the FS is to characterize the human health and environmental risks of radionuclide concentrations in Parcel F sediments. The estimate of risk from radionuclides in marine sediments is much less documented compared to soils. The DGI SAP addendum and the FS Addendum will address this important subject and how it pertains to Action Levels.

Number of Samples and Locations

Screening Survey

Fifty sediment samples will come from open water sites and approximately 15 samples from suction structures at drydocks 2, 3, and 4 (five samples in each structure). Samples will undergo radiological screening on the vessel and will be analyzed at the onsite laboratory for the six radionuclides of concern. Areas of greatest interest are those locations where radiological activities are documented (e.g., berths where CROSSROADS ships were de-contaminated, drydocks, storm drains downstream from buildings where G-RAM was utilized and potentially released). A summary of the historical site use is provided in Attachment A. A comprehensive history of radionuclide activities is provided in the two volumes of the HRA. The rationale for determining the number of samples and what laboratory analyses will be performed on these samples is described in the following worksheets and Attachment #17-1. Table 17-1 describes the number of samples and the sample locations for the screening study.

DGI

Because of the uncertainty regarding the nature and extent of the radionuclide levels within Parcel F, a two phased approach has been developed by Battelle. The first phase is a screening survey encompassing all areas of Parcel F that will provide information to design a focused, comprehensive DGI. A focused DGI will provide a strong scientific foundation for the FS Addendum and any necessary remedial actions. An addendum to the SAP will be prepared for the DGI that encompasses the screening results and satisfies the requirements of the FS Addendum.

Screening Survey Field Sampling Methodology

- Sediment samples for ROC:
 - Sediment cores (~3 foot length or longer) will be collected with a piston core or a vibracore sampler for analysis of radionuclides at various depths (depending on field screening results). Coring will be performed by Battelle staff with vessel and staff support from subcontractors (e.g., SEI). The contractor(s) will have the appropriate and current certifications, experience, and training.
 - Surface sediment samples will be collected if/where coring is not possible with a modified stainless steel Van Veen grab sampler for analysis of radionuclides. Grab samples will be

- collected by Battelle staff with vessel and staff support from subcontractors (e.g., SEI).
- Tentative: Collect sediment from the suction structures at drydocks 2, 3, and 4 in the Berths North Area using divers. Sediment samples will be collected with a diver core (plastic) or plastic scoop and jar. Samples will be analyzed for ROC
- Two field instruments will be used to monitor and screen samples for radionuclides, a Ludlum Model-2241-3 Digital Scaler/Ratemeter and a Ludlum Model-3030E Alpha/Beta Scaler. Details of their use are provided in Attachment 8 of the APP; *Radioactive Materials Management Plan for Radiological Data Gap Investigation*

Descriptions of the sample collection methods are provided in Attachment #17-1. Examples of field forms are provided in Attachment #17-2.

Sample locations

- Screening survey
 - Fifty sample locations are identified in Figures 17-1 through 17-5. Tentative sampling is considered for 3-5 locations within each of the suction structures for drydocks 2, 3 and 4 in the Berths North Area. The sample types and locations are listed in Table 17-1.
- DGI
 - The exact locations and sample types and analyses will be determined after review and analysis of the screening survey data and will be provided in an addendum to this SAP.

Figure 17-1 provides an overview of the sampling areas and locations within Parcel F. SAP Worksheets 17-1 to 17-4 (accompanied by Figures 17-2 to 17-5) describe the rationale for the sampling design. A summary of the rationale is provided in Table 17-2.

Table 17-1. Screening Survey Summary of Proposed Samples with General Rationale

Area	Sample Matrix/ Analysis	No. of Sample Locations	Total No. of Samples	General Rationale
Submarine Base Area	Sediment/ROC	10	10	Collect surface and subsurface sediment samples and measure for ROCs. Sampling numbers and locations are derived from two criteria: (1) suspected historical sites of radionuclide related activities; (2) systematic areal coverage to assess non-documented discharges.
Berths - North	Sediment/ROC	18	18	Collect surface and subsurface sediment samples and measure for ROCs. Sampling numbers and locations are derived from two criteria: (1) suspected historical sites of radionuclide related activities; (2) systematic areal coverage to assess non-documented discharges.
	Sediment/ROC	15*	15*	*Tentative sampling within suction structures at drydocks 2, 3 and 4.
Berths - South	Sediment/ROC	12	12	Collect surface and subsurface sediment samples and measure for ROCs. Sampling numbers and locations are derived from two criteria: (1) suspected historical sites of radionuclide related activities; (2) systematic areal coverage to assess non-documented discharges.
South Basin	Sediment/ROC	10	10	Collect surface and subsurface sediment samples and measure for ROCs. Sampling numbers and locations are derived from two criteria: (1) suspected historical sites of radionuclide related activities; (2) systematic areal coverage to assess non-documented discharges.

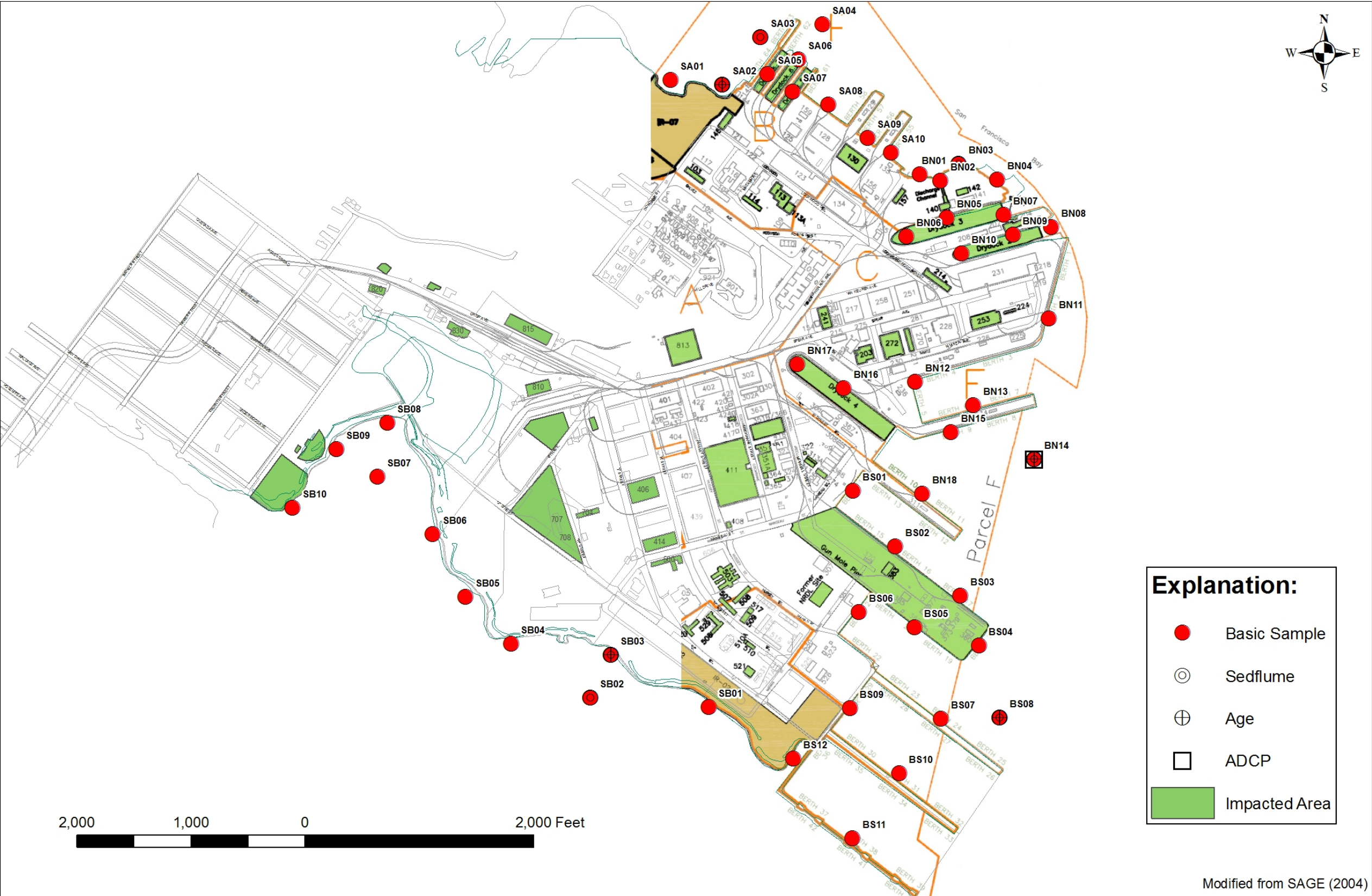


Figure 17-1. Proposed Sampling Locations for HPS Parcel F

SAP Worksheet #17-1 - Sampling Design and Rationale for the Submarine Base Area

ROCs may be present in the Submarine Base Area from drydock operations. Additionally, onshore operations involving radionuclides may have released ROCs through the storm drain system and through general run-off and accidental release of radionuclide enriched materials.

For the screening survey, 10 sediment samples and one age dating core are proposed for collection and analysis. Proposed locations are provided in Figure 17-2. ROCs are Cs-137, Ra-226, Pu-239, Sr-90, and U-235.

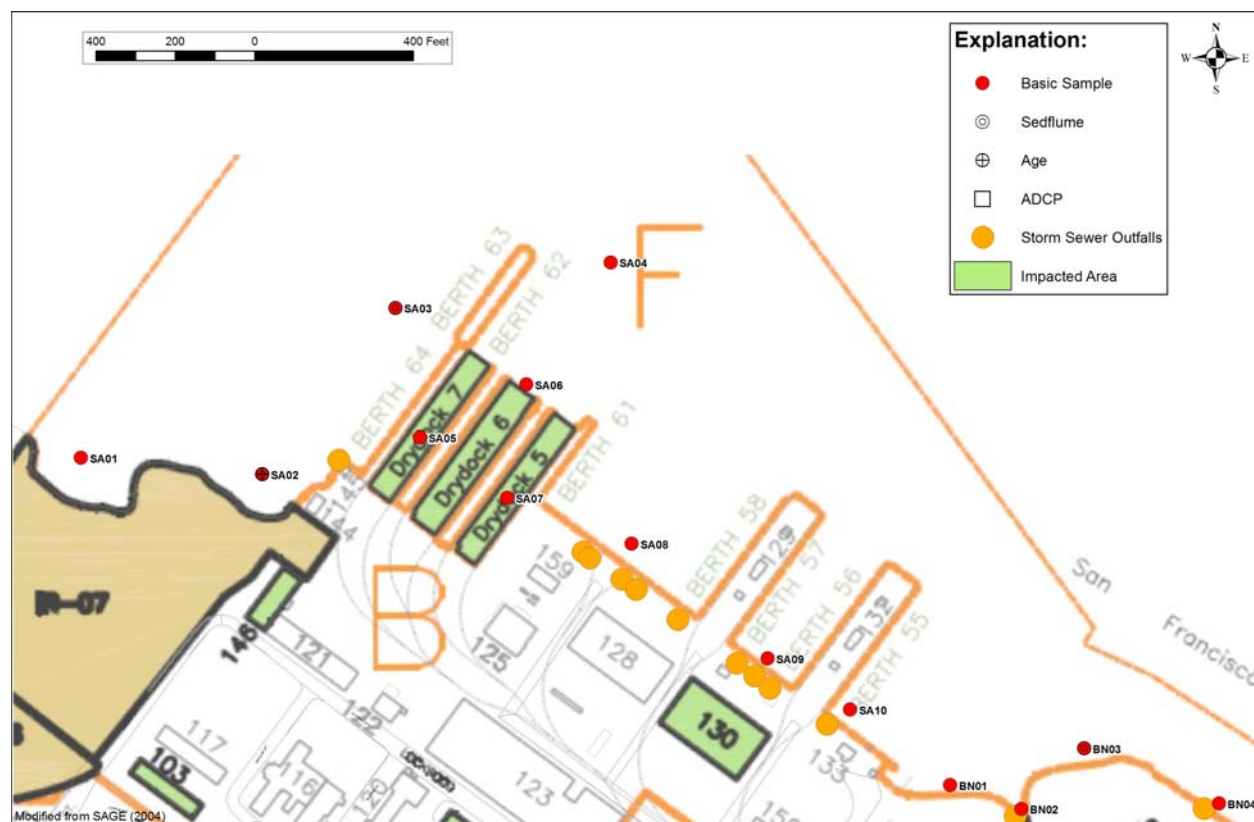


Figure 17-2. Proposed Sampling Locations for the Submarine Area

SAP Worksheet #17-2 - Sampling Design and Rationale for the Berths-North Area

ROCs may be present in the Berths – North Area from drydock operations directly associated with the CROSSROADS program. Additionally, onshore operations involving radionuclides may have released ROCs through the storm drain system and through general run-off and accidental release of radionuclide enriched materials.

For the screening survey, 18 sediment samples are proposed for collection and analysis, and 15 are tentatively planned for collection by divers in the suction channels for drydocks 2, 3 and 4. Proposed locations are provided in Figure 17-3. ROCs are Cs-137, Pu-239, Ra-226, Sr-90, and U-235.

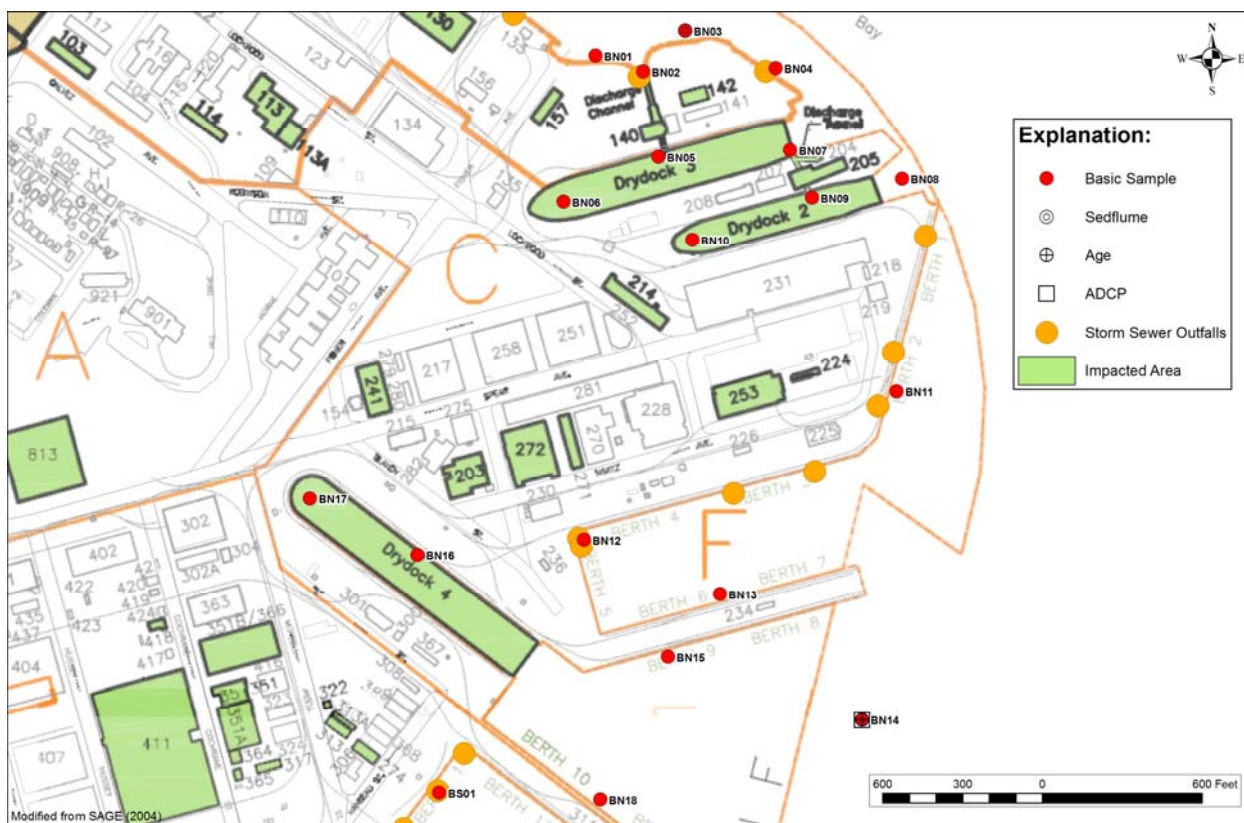


Figure 17-3. Proposed Sampling Locations for the Berths – North Area

SAP Worksheet #17-3 - Sampling Design and Rationale for the Berths – South Area

ROCs may be present in the Berths – South Area primarily from operations involving ROCs at the Mole Pier. Additionally, onshore operations involving radionuclides may have released ROCs through the storm drain system and through general run-off and accidental release of radionuclide enriched materials.

For the screening survey, 12 sediment samples are proposed for collection and analysis. Proposed locations are provided in Figure 17-4. ROCs are Cs-137, Pu-239, Ra-226, Sr-90, and U-235.

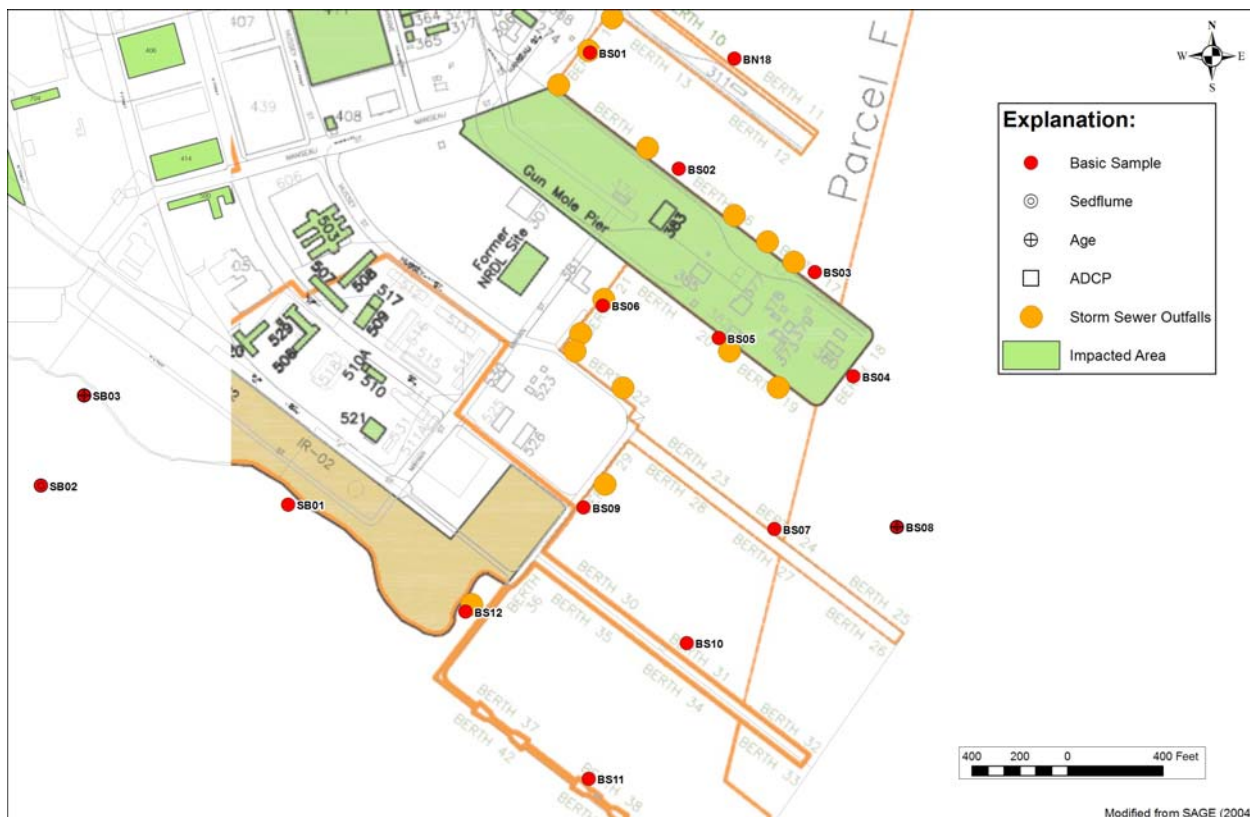


Figure 17-4. Proposed Sampling Locations for the Berths – South Area

SAP Worksheet #17-4 - Sampling Design and Rationale for the South Basin Area

ROCs may be present in the South Basin area from onshore operations involving radionuclides and release of ROCs through the storm drain system and through general run-off and accidental release of radionuclide enriched materials. The nearshore area along the northern shore was used as a landfill and a variety of materials were disposed of that had coatings of paint containing radium. In addition, the area on the northwest was used to test materials containing Cobalt-60. Since the half-life of cobalt is short (<6 years), the likelihood of significant levels is minimal.

For the screening survey, 10 sediment samples are proposed for collection and analysis. Proposed locations are provided in Figure 17-5. ROCs are Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235.

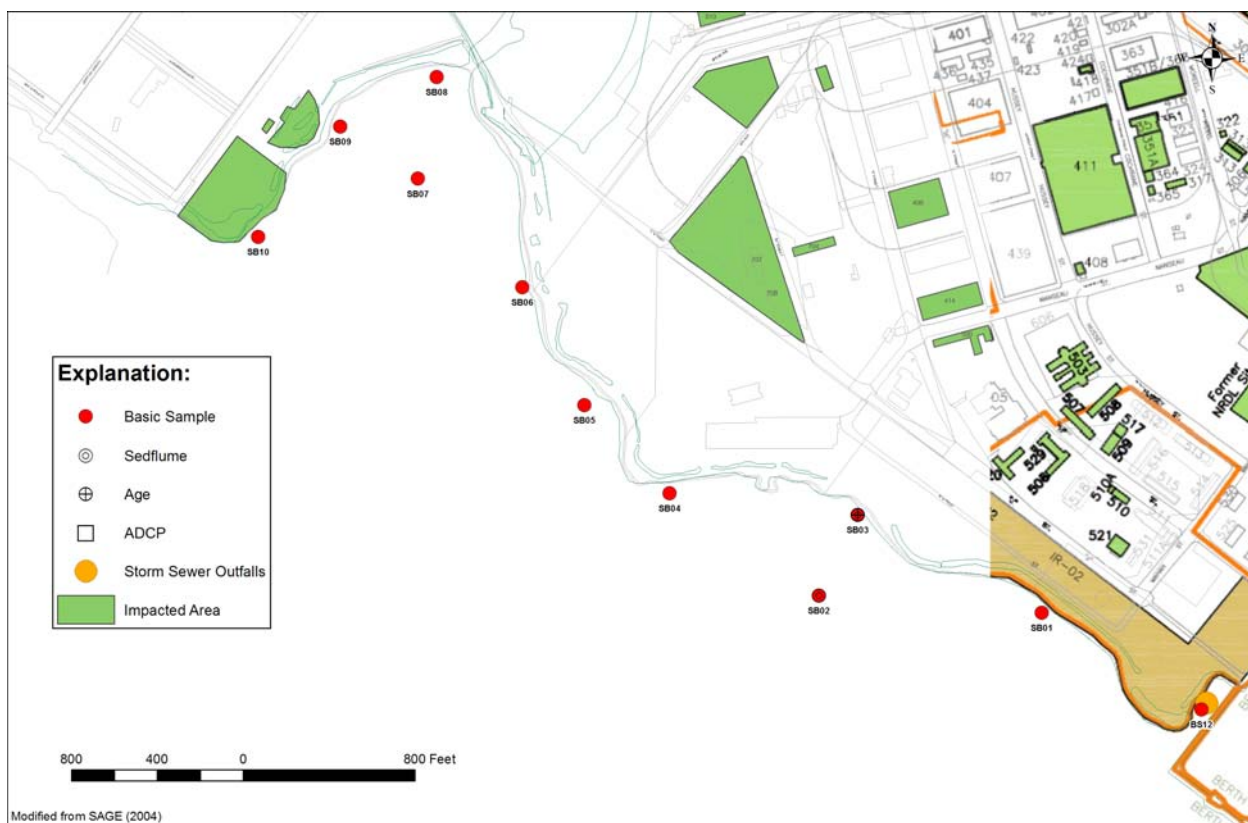


Figure 17-5. Proposed Sampling Locations for the South Basin Area

Table 17-2. Station Locations for the Screening Survey

Station ID	Easting	Northing	Samples	Rational
	CA State Planar, Zone 3 NAD27, Ft			
SA01	1459816.2	454097.1	ROC	Spatial coverage
SA02	1460272.1	454055.4	ROC	Adjacent to storm drain close to Buildings of Concern (BOC; 146), potential Sedflume location
SA03	1460607.2	454473.1	ROC	Offshore reference, potential Sedflume location
SA04	1461149.1	454587.8	ROC	Background confirmation
SA05	1460668.6	454148.5	ROC	Drydock 7
SA06	1460936.4	454280.2	ROC	Outer edge of drydock 6
SA07	1460888.4	453995.8	ROC	Drydock 5
SA08	1461201.9	453880.6	ROC	Spatial coverage
SA09	1461543.6	453591.1	ROC	Adjacent to storm drain close to BOC (130)
SA10	1461751.8	453462.4	ROC	Spatial coverage and coverage of storm drain near BOC (130)
BN01	1462003.5	453271.8	ROC	Adjacent to storm drain close to BOC (157) and drydock operations
BN02	1462182.6	453212.2	ROC	Drydock 3 discharge channel
BN03	1462340.2	453364.4	ROC	Adjacent to storm drain close to BOCs (140,142) and drydock operations, potential Sedflume location
BN04	1462679.9	453225.4	ROC	Spatial coverage, also adjacent to storm drain close to BOC (142)
BN05	1462239.3	452892.3	ROC	Drydock 3 near suction opening
BN06	1461882.3	452723.6	ROC	Western end of drydock 3
BN07	1462735.0	452917.9	ROC	Near discharge structure for drydock 2
BN08	1463155.6	452810.3	ROC	Eastern (outer) edge of drydock 2
BN09	1462817.3	452738.8	ROC	Near suction structure drydock 2
BN10	1462367.3	452579.1	ROC	Western end of drydock 2
BN11	1463134.9	452008.3	ROC	Spatial coverage and adjacent to storm drain close to BOCs (224, 225)
BN12	1461959.3	451451.1	ROC	Adjacent to storm drain close to BOCs (203, 271, 272)
BN13	1462471.5	451246.8	ROC	Spatial coverage
BN14	1463004.5	450771.7	ROC	Offshore reference, potential Sedflume location
BN15	1462275.7	451010.2	ROC	Spatial coverage
BN16	1461334.3	451394.6	ROC	Center of drydock 4
BN17	1460929.8	451606.9	ROC	NW end of drydock 4
BN18	1462021.4	450471.9	ROC	Spatial coverage
BN19	TBD	TBD	ROC	Suction structure drydock 2
BN20	TBD	TBD	ROC	Suction structure drydock 2
BN21	TBD	TBD	ROC	Suction structure drydock 2

Table 17-2. Station Locations for the Screening Survey (Continued)

Station ID	Easting	Northing	Samples	Rational
	CA State Planar, Zone 3 NAD27, Ft			
BN22	TBD	TBD	ROC	Suction structure drydock 2
BN23	TBD	TBD	ROC	Suction structure drydock 2
BN24	TBD	TBD	ROC	Suction structure drydock 3
BN25	TBD	TBD	ROC	Suction structure drydock 3
BN26	TBD	TBD	ROC	Suction structure drydock 3
BN27	TBD	TBD	ROC	Suction structure drydock 3
BN28	TBD	TBD	ROC	Suction structure drydock 3
BN29	TBD	TBD	ROC	Suction structure drydock 4
BN30	TBD	TBD	ROC	Suction structure drydock 4
BN31	TBD	TBD	ROC	Suction structure drydock 4
BN32	TBD	TBD	ROC	Suction structure drydock 4
BN33	TBD	TBD	ROC	Suction structure drydock 4
BS01	1461415.8	450496.8	ROC	Spatial coverage and adjacent to storm drain close to BOCs (274, 313)
BS02	1461788.0	450009.1	ROC	Spatial coverage at Gun Mole Pier
BS03	1462357.8	449574.9	ROC	Spatial coverage at Gun Mole Pier
BS04	1462519.6	449136.3	ROC	Spatial coverage at Gun Mole Pier
BS05	1461954.9	449296.8	ROC	Spatial coverage at Gun Mole Pier
BS06	1461469.6	449433.9	ROC	Spatial coverage and adjacent to storm drain close to BOC (NRDL)
BS07	1462188.3	448497.0	ROC	Spatial coverage
BS08	1462702.9	448506.2	ROC	Offshore reference, potential Sedflume location
BS09	1461389.0	448587.0	ROC	Spatial coverage and adjacent to storm drain connected to BOCs (503, 507, 508, 509, 517)
BS10	1461820.7	448017.9	ROC	Spatial coverage
BS11	1461409.8	447447.2	ROC	Spatial coverage
BS12	1460893.5	448149.0	ROC	Spatial coverage and adjacent to storm connected to BOCs (506, 510, 520, 521, 529)
SB01	1460150.1	448600.3	ROC	Spatial coverage and adjacent to storm drain close to BOCs (506, 510, 520, 521, 529)
SB02	1459112.6	448679.6	ROC	Spatial coverage and adjacent to storm drain close to BOCs (506, 510, 520, 521, 529), potential Sedflume location
SB03	1459294.2	449056.5	ROC	Offshore reference, potential Sedflume location
SB04	1458418.6	449156.0	ROC	Spatial coverage along South Basin shore
SB05	1458021.6	449564.5	ROC	Spatial coverage along South Basin shore
SB06	1457733.9	450114.5	ROC	Spatial coverage along South Basin shore
SB07	1457247.9	450619.6	ROC	Offshore reference

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

Table 17-2. Station Locations for the Screening Survey (Continued)

Station ID	Easting	Northing	Samples	Rational
	CA State Planar, Zone 3 NAD27, Ft			
SB08	1457334.2	451092.8	ROC	Spatial coverage along South Basin shore
SB09	1456886.6	450862.6	ROC	Spatial coverage and near former weapons testing area
SB10	1456504.6	450347.9	ROC	Spatial coverage and near former weapons testing area

TBD: To be determined. SCUBA divers will collect sediment at the suction structures of drydocks 2, 3, and 4 when possible and safe. Safe access will not be confirmed until divers submerge and investigate site specific underwater conditions. Sedimentation may be limited within the structures, further affecting sample collection plans. The locations for the sampling of the suction structures of drydocks 2, 3, and 4 will be approved by the RPM and documented in a field change order.

Decontamination

Decontamination will be performed on all field equipment to avoid cross-contamination between samples and to ensure the health and safety of field personnel. The following sequence will be used to clean equipment and sampling devices prior to and between each use:

- (1) Wash with Liquinox™ detergent and site water and clean with a brush.
- (2) Rinse with site water.
- (3) Rinse with distilled water.
- (4) Place/store the sampling equipment on a clean surface.

The SOP by which all equipment will be decontaminated can be found in Attachment B.

Disposal of IDW

Generation of IDW will be minimized to the greatest extent possible. Handling of IDW is limited to the proper disposal of sampling equipment, personal protective equipment (PPE), contaminated sediment, and decontamination liquids. Handling of IDW will be supervised by the Radiation Safety Technician (RST).

General procedures are as follows:

- Staff shall ensure that secondary containment is used for the transfer of any unsealed radioactive material outside of radiologically restricted areas. This will prevent the spread of contamination outside of restricted areas.
- The RST will survey the outside of all radioactive material containers prior to removal from storage, radioactive waste cans, or posted contaminated areas. Transfer to a radiologically clean secondary container is an acceptable alternative. Survey, in the context of this recommendation, generally refers to frisking with a radiation detection instrument, but also includes collecting smears where warranted.
- Personnel shall periodically perform smears and/or direct frisk (if possible) of work areas while work is in progress in addition to performing periodic hand and foot frisking.
- Personnel with open skin wounds will not work with unsealed radioactive material without an adequate waterproof covering on the wound (as determined by Radiation Safety).
- Items that have been used in radiologically restricted areas will not be released for unrestricted use until they have been verified by Radiation Safety to meet the established release criteria. Only Radiation Safety is authorized to release materials or items for unrestricted use.

All IDW will be transferred to the HPS on-site radiological contractor, Tetra Tech EC with appropriate documentation. Tetra Tech EC will then dispose of the IDW in accordance with all applicable local, state and federal regulations.

Attachment #17-1: Summary of Field Sampling Methods

A17-1-1 Piston Core Sediment Sample Collection

Sediment core samples will be collected by Battelle and SEI from a vessel with a piston core sampler when possible. Samples will be collected as detailed in Battelle SOP 5-342, "Collecting Sediment Cores with a Piston Push/Hammer Corer". The target core depth is 100cm, factors such as refusal and other circumstances beyond control (e.g. debris or organism interference) may reduce the penetration/retrieval depth.

If possible, cores will be collected at all locations described in Table 17-2 in the SAP. This will allow confirmation of the sediment depth that background levels are present if any elevation of radionuclide concentrations are measured in surface or near surface sediments. The piston core consists of a stainless steel head, rigid cellulose acetate butyrate (CAB) tubing (2.75" outside diameter and 2.66" inside diameter) and a Teflon piston with two silicon rubber seals. The core tube is held vertical when deployed in a stainless steel frame (water >20' deep) or operated from an aluminum pole (water <20' deep).

The core system is deployed and retrieved as detailed in Battelle SOP 5-342. After retrieval, the core tube is sealed with an HDPE cap and secured with tape if necessary (e.g. high water content cores or for transit to the laboratory). The core will be screened with equipment and methods described in the APP (Battelle 2008). If necessary, sediment will be removed from the tubing. If high water content and mixing has occurred at the surface sediment/water interface, the tubing with sediment is positioned upright undisturbed for ~10 minutes to allow settling of fine particles. After ~10 minutes, the water is drained slowly by puncturing a small hole in the liner at the sediment water interface. The core length is measured to the nearest 0.1 ft and recorded on the field log form.

All collection information will be recorded on field log forms (Attachment #17-2).

A17-1-2 Grab Sample Sediment Collection

Surface sediments will be collected by Battelle and SEI from a vessel with a modified stainless steel Van-Veen grab sampler when it is not practical or possible to collect a piston core sample.

The grab sampler will collect either a 0.04-m² or a 0.1-m² area of sediment from 10-30 cm deep according to Battelle SOP 5-169, *Collection and at Sea Processing of Benthic Grab Samples*. If debris or rocks prevent sampling at the exact station location, then the vessel will be relocated as close to the original location as possible so that an acceptable grab sample can be taken. Upon retrieval, the sediment sample will be inspected for disturbance (e.g., excessive washing, slumping, or interference of jaw closure). If deemed acceptable, the grab sample sediment depth and a general description (color, texture, odor) of the sediment type will be recorded on the sample collection form. If unacceptable, the sample will be discarded and a new one collected.

Sediment samples will be processed on the vessel. Sediment will be removed from the grab with a stainless steel or Kynar coated utensil, avoiding the sides of the grab. Sediment will be screened with instruments described in Appendix 8 of the APP 'Radioactive Material Management Plan' Table 1. Samples destined for analysis at the laboratory will be placed into clean, pre-labeled polyethylene containers.

All collection information will be recorded on field log forms (Attachment #17-2).

A17-1-3 Sediment Sample Collection in the Drydock Intake Structures Using Divers (Tentative)

The dive team will consist of four staff from SEI and two Battelle staff. Surface-supplied air (SSA) will be the dive method. The SEI SSA team will consist of a diving supervisor, diver, standby diver and tender. The roles and responsibilities of the dive team are outlined below. If funded and approved, a full dive plan including health and safety actions will be submitted as an Addendum to both the SAP and the APP.

The dive team will consist of a Diving Supervisor, a designated diver, a standby diver, and a tender. Battelle staff will assist in radiological screening of samples, equipment, and staff, and sample control.

After proceeding thru the mobilization process, final briefings, staff and equipment set up, in water dive operations will commence. The diver will be equipped with a light, a video camera, and sample collection equipment. The tethered diver will descend to the opening of the suction structure. The diver will report back to the deck team and proceed slowly and safely into the suction structure. The diver will proceed into the structure and collect from three-five sediment samples if/where sediment has been deposited. After the samples are collected, the diver will return to the vessel.

Full details of diving operations will be provided by with the response to the request for proposal (RFP), Mod 1 to the existing contract due 10 November 2008.

A17-1-4 Sample Preservation, Packaging, and Shipment

Samples delivered to the onsite laboratory will be packaged and shipped in accordance with the procedures in the Battelle SOP 5-210, *Packaging and Shipping of Samples*. The sediment samples will be hand delivered to the onsite laboratory operated by New World Technology within 24 hours of sample collection. NWT will ship out 10% of samples to TestAmerica for QA/QC purposes in accordance with procedures defined in the Tetra Tech EC SAP for Base-Wide Storm Drain and Sanitary Sewer Removal at Hunters Point Shipyard (Tetra Tech, 2008).

A17-1-5 Sample Containers and Labeling

Sample container, sample size and preservation requirements are provided in Worksheet 19. Contact information for each of the laboratories is provided in Worksheet 30.

Sample containers will be labeled with waterproof, adhesive-back labels. Sample labels will provide sufficient detail to uniquely identify each sediment sample and allow tracking to field activities.

The labeling scheme for sample identification will include the area identifier (SA – Submarine Base Area, BN – Ship Berths North, BS – Ship Berths South and SB – South Basin), and a location number (e.g. 01).

For example, ID number SA01 represents the sample taken at location 01 in the Submarine Base Area. See Worksheet #18 for specific sample locations and IDs.

Sample container labels must include a unique sample identification number, matrix, collection date, sample collector's name, container number and total number of containers (e.g., 1 of 2, 2 of 2). An example is provided below.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

U.S. Navy - Hunters Point Parcel F Sediment Screening Study

Battelle Project Number G927502

Sample ID: SA01

Station ID: _____

Date: _____

Time (local): _____

Matrix: Sed Water Other

Collector Initials: _____

Analysis: ROC

Sedflume

Particle Size

Age Dating

Other

Preservative: 4°C Other _____

Container _____ of _____

Battelle
The Business of Innovation

Phone: 614.424.7939

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA
Revision Date: NA

Attachment #17-2 – Forms

 The Business of Innovation		Project #: _____ Project Name: _____ Location: _____ Client: _____	G927502 <i>HPS Parcel F</i> <i>HPS, San Francisco</i> <i>US Navy</i>	Vessel: _____ Chief Scientist: _____ Date: _____
---------------------------------------	--	---	---	--

Station ID:		Time On Station:		Attempt:	Feet
Station Descriptor:		Date:		1	Total Penetration:
Core Sample ID:		Northing (ft):			Recovery:
Logged by:		Easting (ft):			Time of collection:
Collection Mechanism:		GPS Accuracy:		2	Total Penetration:
Coordinate System:	CA State Planar/Zone3/NAD27/USFt	Water Depth (ft):			Recovery:
		Tide (ft):			Time of collection:
		Time Off Station:			

As Sampled depth below mudline (ft)+	Lithology - Include USCS code	Type	Color	Consistency	Maximum particle size	Odor	Sample IDs	Comments
1								
2								
3								
4								

Comments: _____

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA



USNAVY HPS PARCEL F RADIONUCLIDE SCREENING STUDY

Daily Log Form

Date:	Recorder:	Project #: G927502
Start Time (local):		Stop time (local):
Sampling Area(s):		
Weather Conditions:		
Sampling Activities (by Station):		
Comments:		
Field Personnel:		
Health and Safety Issues:		

Field Team Leader Review and Approval _____

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)

Revision: NA

Revision Date: NA



USNAVY HPS PARCEL F RADIONUCLIDE SCREENING STUDY

DGPS DAILY LOG

Project No. G927502		Date:		Recorder:	
DGPS (make/model/SN):			Coordinate System and units:		
Primary dGPS Check					
Time of check (local):			DGPS Estimate of Accuracy (PDOP):		
Benchmark or Reference Point ID:			Benchmark or Reference Point Established By:		
Established Latitude/Northing:			Established Longitude/Easting:		
Measured Latitude/Northing:			Measured Longitude/Easting:		
Instrument Measured Displacement (meters):					
Displacement Acceptable? (≤ 5 m): YES NO					
Secondary dGPS Check					
Time of check (local):			DGPS Estimate of Accuracy (PDOP):		
Benchmark or Reference Point ID:			Benchmark or Reference Point Established By:		
Established Latitude/Northing:			Established Longitude/Easting:		
Measured Latitude/Northing:			Measured Longitude/Easting:		
Instrument Measured Displacement (meters):					
Displacement Acceptable? (≤ 5 m): YES NO					
Field Activities / Comments / Observations:					

Field Team Leader Review and Approval _____

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

USNAVY HPS PARCEL F RADIONUCLIDE SCREENING STUDY SEDIMENT GRAB SAMPLING LOG

Battelle Project No. G927502		Date:		Recorder:					
Station ID:		Time On Station: (local)				Time Off Station: (local)			
Northing (CA Planar/Zone3/NAD27/USFt)				Easting (CA Planar/Zone3/NAD27/USFt)				DGPS Accuracy Estimate:	
Sample Time: (local)		Grab sample depth (in):			Vessel:				
Water depth (ft):		Sampler type:			Sampling Staff:				
Sediment (in)	Sample Description					Sample Type (check)		Sample ID	
0-6	Color: Black Dark Gray Gray Brown Other: _____ Type: Cobble Gravel Sand (coarse med fine) Silt Clay Wood chips Shells or Shell Hash Other: _____ Odor: None Slight Moderate Strong Petroleum H2S Other: _____ Misc: Biota _____ Detritus _____					Radionuclides			
						Grain Size			
						TOC			
<i>Grab Number (A= Accepted; R = Rejected)</i> <i>Codes: DB = Debris Interference; DS = Disturbed Surface; NS = No Sediment in sampler; OP = Over Penetration; OT = Other</i>									
1	2	3	4	5	6	7	8	9	10
Field Activities / Comments / Observations:									

Field Team Leader Review and Approval _____

SAP Worksheet #18 - Sampling Locations and Methods/SOP Requirements Table

This section presents the methods and SOP requirements for the sampling efforts. As described in worksheets 10 and 17, a two phased sampling approach will be implemented.

- Screening Survey: The screening survey goal is to determine on a broad scale the nature and extent of radionuclides concentrations (ROC = Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235) within Parcel F sediments.
- DGI: The second survey (the DGI) will be performed to gather data to support an addendum to the Parcel F FS. The final design of the DGI will be based upon data collected and analyzed from the screening survey and will be provided as an amendment to this SAP. In addition to the radionuclide data, the DGI may include sediment age dating, water column velocity measurements, and Sedflume (sediment erosion potential) data.

The rationale for determining the number of samples and what laboratory analyses will be performed on these samples is described in Worksheet 17. The system for Sample ID number is described in Worksheet #27.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

Table 18-1. Screening Survey Sampling Methods and SOPs

Sampling Location / ID Number	Matrix	Sediment Depth (cm below mudline)	Analytical Group	Number of Samples ⁽¹⁾ (+ field duplicates)	Sampling SOP Reference
Submarine Area / SA01 through SA10	Sediment	0 - 100	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	10	ACES 5-169-03 ACES 5-342-01
Berths North / BN01 through BN18	Sediment	0 - 100	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	18	ACES 5-169-03 ACES 5-342-01
Berths South / BS01 through BS12	Sediment	0 - 100	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	12	ACES 5-169-03 ACES 5-342-01
South Basin / SB01 through SB10	Sediment	0 - 100	Radionuclides (Co-60, Cs-137, Pu-239, Ra-226, Sr-90, and U-235)	10	ACES 5-169-03 ACES 5-342-01

(1) Samples designated for offsite laboratory analysis will be randomly selected prior to sampling. Field duplicate samples are not collected for sediment due the inherent variability of the sediment matrix.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #19 - Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Sediment	Gamma Spectroscopy (NWT)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry / RCHL-A-05, Rev 1	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Gamma Spectroscopy (Test America)	EPA 901.1 Mod Gamma/ SOP ST-RD-0102, Rev 5	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Alpha Spectroscopy (NWT)	Department of Energy (DOE) HASL-300 Method or equivalent / SOP RCHL-A-08, Rev 2	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Alpha Spectroscopy (Test America)	DOE A-01-R Mod Iso-U/ SOP ST-RD-0210, Rev 5	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Strontium-90 (NWT)	DOE Method Sr-01/Sr-02 or equivalent/ RHCL-A-07, Rev 0	250-mL plastic container	250-mL or 500-mL	None	None
Sediment	Strontium-90 (Test America)	EPA 905.0 Mod or DOE SR-03-RC Mod Sr-90/ SOP ST-RD-0403, Rev 7	250-mL plastic container	250-mL or 500-mL	None	None
Swipe	Alpha/beta emitting radionuclides (NWT)	U.S. EPA Method 9310 or equivalent/ SOP RCHL-A-02, Rev 1	2 cloth swipes, 1.75 in. diameter	N/A	None	None

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #19 - Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference	Containers (number, size, and type)	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Swipe	Alpha/beta emitting radionuclides (Test America)	U.S. EPA Method 9310 or equivalent/ SOP ST-RD-0210, Rev 5	2 cloth swipes, 1.75 in. diameter	N/A	None	None

N/A – not applicable

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #20 – Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations⁽¹⁾	No. of Field Duplicates⁽²⁾	No. of MS /MSDs	No. of Field Blanks	No. of Equip. Blanks⁽³⁾	No. of VOC Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	Radionuclides	50	0	3	0	5	0	0	58

(1) The number of samples for the DGI will be determined after review of the screening survey data and provided as an amendment to this SAP.

(2) Field duplicate samples are not collected for sediment due the inherent variability of the sediment matrix.

(3) Equipment blanks are collected at a rate of one per sampling day; assuming five days for sampling.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #21 - Project Sampling SOP References Table

Reference Number ⁽¹⁾	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
5-169-03	Collection and at Sea Processing of Benthic Grab Samples. Rev. 03	Battelle Applied Coastal and Environmental Services	Sediment Grab Sampler	N	Standard Operating Procedures for sampling are included in Attachment B.
5-342-01	Collecting Sediment Cores with a Piston Push/Hammer Corer. Rev. 01	Battelle Applied Coastal and Environmental Services	Piston Corer	N	
5-296-01	Cataloging and Processing Sediment Cores. Rev. 01	Battelle Applied Coastal and Environmental Services	Piston and/or vibracorer	N	
5-210-05	Packaging and Shipping of Samples. Rev. 05	Battelle Applied Coastal and Environmental Services	All samples collected	N	

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GPS	No calibration required.	<ul style="list-style-type: none"> • Charge batteries • Clean of dust, dirt, and grease • Store instrument in case when not in use 	<ul style="list-style-type: none"> • Verify connection to satellites • Verify strength of signal • Check mask angle for satellites • Check if there will be a problem of vegetation density • Check if possible radio interference in area 	Instrument is clean of dust, dirt, and grease	Daily	instrument has digital readout that verifies connection to satellites and the strength of the signal	if the instrument can not connect to satellites, then the secondary unit will be used to verify that there are no connections	Field Team Leader	Operator Manual

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Large-area scintillation, Ludlum Model 43-89/Ludlum Model-2360 Alpha/Beta Datalogger	Instruments calibrated at 12 month intervals.	<ul style="list-style-type: none"> Change batteries as needed. Clean of dust, dirt, and grease. Store instrument in case when not in use. Avoid immersion in water. Avoid contact with surfaces being surveyed to prevent damage to Mylar window on probe. 	Verify current calibration by inspecting the attached calibration sticker. Perform battery check. Perform response check using designated sealed source.	Visual inspection of the instrument for damage.	Daily, prior to use	Meter not damaged and in good working order. Comparison of date to calibration sticker date. Battery indicator falls within range. Instrument reading falls within established source check range.	Meter taken out of service and sent for repair. For battery check, change batteries and repeat battery check.	RST	Operator Manual

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
NaI 2-inch x 2-inch Scintillation Thermo Scientific Model SPA-3/ Ludlum Model-2360 Alpha/Beta Datalogger	Instrument calibrated at 12 month intervals	<ul style="list-style-type: none"> Change batteries as needed. Clean of dust, dirt, and grease. Store instrument in case when not in use. Avoid immersion in water. 	Verify current calibration by inspecting the attached calibration sticker. Perform battery check. Perform response check using designated sealed source.	Visual inspection of the instrument for damage.	Daily, prior to use	Meter not damaged and in good working order. Comparison of date to calibration sticker date. Battery indicator falls within range. Instrument reading falls within established source check range.	Meter taken out of service and sent for repair. For battery check, change batteries and repeat battery check.	RST	Operator Manual

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Sodium iodide (NaI) Scintillation Micro R Meter Ludlum Model-19	Instruments calibrated at 12 month intervals	<ul style="list-style-type: none"> Change batteries as needed. Clean of dust, dirt, and grease. Store instrument in case when not in use. Avoid immersion in water. 	Verify current calibration by inspecting the attached calibration sticker. Perform battery check. Perform response check using designated sealed source.	Visual inspection of the instrument for damage.	Daily, prior to use	Meter not damaged and in good working order. Comparison of date to calibration sticker date. Battery indicator falls within range. Instrument reading falls within established source check range.	Meter taken out of service and sent for repair. For battery check, change batteries and repeat battery check.	RST	Operator Manual

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #22 - Field Equipment Calibration Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Ludlum Model 43-10-1 Alpha/Beta Sample Counter/Ludlum Model-3030E Alpha/Beta Scaler	Instruments calibrated at 12 month intervals	<ul style="list-style-type: none"> • Change batteries as needed. • Clean of dust, dirt, and grease. • Store instrument in case when not in use. • Avoid immersion in water. 	Verify current calibration by inspecting the attached calibration sticker. Perform battery check. Perform response check using designated sealed source.	Visual inspection of the instrument for damage.	Daily, prior to use	Meter not damaged and in good working order. Comparison of date to calibration sticker date. Battery indicator falls within range. Instrument reading falls within established source check range.	Meter taken out of service and sent for repair. For battery check, change batteries and repeat battery check.	RST	Operator Manual

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #23 - Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
RCHL-A-05, Rev 1	Determination of Gamma Radioactivity in Various Matrices Using ORTEC Detection Systems and Gamma Vision-32 Software, 1/23/08	Definitive	Gamma Emitting Radionuclides	Ortec HpGe Gamma Spectroscopy System	NWT	No
RCHL-A-07, Rev 0	Determination of Strontium 90 Radioactivity in Soil Using Gas Proportional Counting System ICP 9025, 1/23/08	Definitive	Strontium-90	Low-background gas-flow proportional counter	NWT	No
RCHL-A-08, Rev 2	Determination of Actinide Alpha Radioactivity in Soil Using Ortec Alpha Spectroscopy Detection System, 6/30/08	Definitive	Alpha Emitting Radionuclides	EG&G Ortec Alpha Spectroscopy System	NWT	No
RCHL-A-02, Rev 1	Determination of Alpha/Beta Radioactivity on Swipes Using the Protean Gas Proportional Counting System WPC 9550	Definitive	Alpha/Beta Emitting Radionuclides	Protean Gas Proportional Counting System WPC 9550	NWT	No
ST-RD-0102 Rev 5	GammaVision Analysis Rev. 5, 7/28/07	Definitive	Gamma Isotopes	Gamma Spectrometer	Test America-St Louis	Y
ST-RD-0403 Rev 7	Low Background Gas Flow Proportional Counting System Analysis, Rev. 7, 5/30/08	Definitive	Strontium-90	Gas Flow Proportional Counter	Test America-St Louis	N
ST-RD-0210 Rev 5	Alpha Spectroscopy Analysis Rev. 5, 5/30/08	Definitive	Alpha Emitting Radionuclides	Alpha Spectrometer	Test America-St Louis	N

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
EG&G Ortec Beryllium Window HPGe Gamma Spectroscopy System (NWT)	Ortec Gamma Vision-32 A66-B32 Operations Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	RCHL-A-05, Rev 1
Protean Instrument Corp. Low-background gas-flow proportional Counting System ICP 9025 (NWT)	IPC 9025 Operations Manual, Protean Instrument Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	RCHL-A-07, Rev 0
EG&G Ortec Octète™ Alpha Spectrometer (NWT)	Ortec Alpha Vision-32 A36-B32 Operations Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	RCHL-A-08, Rev 2
Protean Gas Proportional Counting System WPC 9550 (NWT)	IPC 9025 Operations Manual, Protean Instrument Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	-recalibration -instrument maintenance -notify lab manager	Laboratory Manager	RCHL-A-02, Rev 1

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gas Flow Proportional Counter (Test America)	<ul style="list-style-type: none"> • Plateau generation and/or verification • Discriminator setting • Initial long background count • Mass attenuated efficiency calibration • Eight source dual/single calibration curves 	Annual	<ul style="list-style-type: none"> • Plot efficiencies vs masses • Calculate equation of curve – degree ≤ 3 • Remove outliers >15% deviation from theoretical values but not more than 20% of total points • Calculate coefficient of determination (R^2). R^2 must be ≥ 0.9 • Verify calibration with second source standard count – must be within 30 percent of true value and mean across all detectors <10% 	<ul style="list-style-type: none"> • Recalibrate • Instrument maintenance • Consult with Technical Director 	Group Leader	ST-RD-0403 Rev 7

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer (Test America)	1. Energy calibration 2. Full width at half-maximum (FWHM) calibration	1. Annual 2. Annual	For Energy and FWHM calibration: <ul style="list-style-type: none">• Within 0.5% or 0.1KeV for all calibration points• Within 8% for all calibration points• Verify with second source that always contains at least Am-241, Co-60, and Cs-137• Must be $\pm 10\%$D for each nuclide	<ul style="list-style-type: none">• Recalibrate• Instrument maintenance• Consult with Technical Director	Group Leader	STD-RD-0102 Rev 5

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #24 - Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer (Test America)	1. Energy calibration 2. Efficiency calibration and background check 3. Subtraction spectrum, 4. Pulser check and background check	1. Monthly 2. Monthly 3. Monthly 4. Daily	1. Three isotopes in 3-6 MeV range all within ± 40 KeV of expected value 2. $>20\%$ 3. Ultra Low Level: < 2 CPM Low Level: $< 2-4$ CPM Routine Level: $< 4-10$ CPM High Level: $< 10-20$ CPM 4. Pulser energy, peak centroid, peak resolution, peak area, calibration and background must pass statistical "boundary" out-of-range test	<ul style="list-style-type: none"> Recalibrate Instrument maintenance Consult with Technical Director If background check is > 20 CPM, then detector requires maintenance	Group Leader	ST-RD-0210 Rev 5

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
EG&G Ortec Beryllium Window Gamma Spectroscopy System (NWT)	Clean cave; fill LNO2/physical check/physical activity	Weekly	Acceptable background	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-05, Rev 1
	QA check/Background check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-05, Rev 1
	QA check/Source check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-05, Rev 1
	QC check/sample duplicates	Once per batch or every 20 samples	lowest activity is within twenty percent of the highest activity	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-05, Rev 1
Protean Instrument Corp. Low-background gas-flow proportional Counting System ICP 9025 (NWT)	QA check/Background check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-07, Rev 0
	QA check/Source check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-07, Rev 0

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
	QC check/sample duplicates/	Once per batch or every 20 samples	lowest activity is within twenty percent of the highest activity	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-07, Rev 0
	QA check P10 gas supply	Daily	adequate	Resupply	Lab Manager	RCHL-A-07, Rev 0
EG&G Ortec Octète™ Alpha Spectrometer (NWT)	QA check/Background check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-08, Rev 2
	QA check/Source check/Check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-08, Rev 2
	QC check/sample duplicates	Once per batch or every 20 samples	lowest activity is within twenty percent of the highest activity	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-08, Rev 2
Protean Gas Proportional Counting System WPC 9550 (NWT)	QA check/alpha source check/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-02, Rev 1
	QA check/beta source check/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-02, Rev 1

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
	QA check/Background blank/check deviation	Prior to use and at a minimum daily	Within 3 sigma of measured population	-recalibrate -Instrument maintenance -consult lab manager	Lab Manager	RCHL-A-02, Rev 1
	QA check P10 gas supply	Daily	Adequate	Resupply	Lab Manager	RCHL-A-02, Rev 1
Gas Flow Proportional Counter (Test America)	1. Clean instrument, physical check 2. Inspect windows 3. QA check, background source count	1. Daily 2. High counts and/or background 3. Daily	1. None applicable 2. No physical defects 3. Within 3 sigma of 20 day population	<ul style="list-style-type: none"> Recalibrate Instrument maintenance Consult with Technical Director 	Group Leader Analyst	ST-RD-0403 Rev 7
Gamma Spectrometer (Test America)	1. Clean cave; fill dewar with N ₂ ; physical check 2. QA check ; background source count	1. Weekly 2. Daily	1. Acceptable background 2. Within 3 sigma of measured population	<ul style="list-style-type: none"> Recalibrate Instrument maintenance Consult with Technical Director 	Group Leader Analyst	ST-RD-0102 Rev 5
Alpha Spectrometer (Test America)	Clean planchette holders; physical check	Monthly	Acceptable background and calibration efficiencies	<ul style="list-style-type: none"> Recalibrate Instrument maintenance Consult with Technical Director 	Group Leader Analyst	ST-RD-0210 Rev 5

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #25 - Analytical and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument/ Equipment	Maintenance Activity/ Testing Activity/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Liquid Scintillation Counter (Test America)	1. QA check; Background and efficiency verification for C-14 and H-3; review daily control data 2. Clean dust and debris from sample deck; physical check 3. Photon multiplier tubes cleaned by manufacturer; physical check	1. Daily 2. Monthly 3. Annually	For all three maintenance activities: within 3 sigma of established baselines and stable baselines for C-14 and H- 3 efficiencies	<ul style="list-style-type: none"> Recalibrate Instrument maintenance Consult with Technical Director 	Group Leader Analyst	ST-RD-0302 Rev 10

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #26 - Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team Leader/Battelle
Sample Packaging (Personnel/Organization): Field Team Leader/Battelle; Project Chemist/NWT
Coordination of Shipment (Personnel/Organization): Field Team Leader/Battelle; Project Chemist/NWT
Type of Shipment/Carrier: Samples for offsite analysis will be shipped via courier or FedEx.
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Coordinator/ NWT/Test America
Sample Custody and Storage (Personnel/Organization): Sample Coordinator/ NWT/Test America
Sample Preparation (Personnel/Organization): Lab Analyst/ NWT/Test America
Sample Determinative Analysis (Personnel/Organization): Lab Analyst/ NWT/Test America
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples will be archived for 60 days after sample analysis results have been reported
Sample Extract/Digestate Storage (No. of days from extraction/digestion): N/A
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Sample Coordinator/ NWT/Test America
Number of Days After Analysis: Samples will be held for 60 days after sample analysis results have been reported.

N/A – not applicable

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #27 - Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): The sediment will be placed into the appropriate, labeled sample containers. Custody seals, which are simple tape seals that are signed, dated and placed over the lid of the transport cooler, will be used for samples shipped off site. See Attachment #27-1 for an example custody seal. The samples will be wrapped in bubble-wrap to prevent breakage and placed in a cooler. A chain-of-custody (COC) will be completed for each cooler and placed inside an airtight re-sealable plastic bag and taped to the inside lid of the cooler. See Attachment #27-2 for an example COC form. Each cooler will be sealed with shipping tape and labeled for identification. The coolers will be sent priority overnight via Fed Ex to a designated laboratory for analysis.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): Upon the receipt of the samples by NWT and Test America, laboratory personnel will inspect the cooler(s) for signs of tampering. The samples will be logged into the facility sample tracking system. The samples will be disposed of by the laboratory unless notified otherwise by Battelle personnel.

Sample Identification Procedures: Each sample collected will be given unique sample identification (ID). The sample ID is project specific and a record of all sample IDs will be kept with the field records and recorded on a COC form. The labeling scheme for sample identification will include the area identifier (SA – Submarine Base Area, BN – Ship Berths North, BS – Ship Berths South and SB – South Basin), and a location number (e.g. 01).

For example, ID number SA01 represents the sample taken at location 01 in the Submarine Base Area. See Worksheet #18 for specific sample locations and IDs.

Chain-of-custody Procedures: The sample ID, matrix, sample collector's name, collection date and time, QC sample designation, along with the laboratory analyses required for each multi-increment sample will be recorded on the COC in the field. Just before the samples are shipped, the sample relinquishment time and date will be documented on the COC by the field team leader (or his designee). The COC will then be signed, placed in an airtight re-sealable plastic bag, taped to the top lid of the cooler, and sealed in the sample cooler. Upon receipt of the sample cooler(s) by Tech Tech or off-site laboratory, the laboratory personnel will inspect the samples for completeness, and document the laboratories reception time and date of the coolers on the COC. The finalized COC will be sent to the field team leader for review.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

ATTACHMENT #27-1: Chain of Custody Record

Project: _____

Sampling Location: _____

Address: _____ Phone: _____

Collector's Signature: _____ Date: _____

Samples shipped to: _____

Analyses Requested				
Sample ID	Date	Time	Description / Preservative	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Relinquished by: _____ Date: _____ Received by: _____ Date: _____

Relinquished by: _____ Date: _____ Received by: _____ Date: _____

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

ATTACHMENT #27-2: Custody Seal

<p style="text-align: center;">CUSTODY SEAL</p> <p>Signature: _____</p> <p>Date: _____</p>

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples

Lab: NWT

Matrix: Sediment

Analytical Group: Strontium-90

Analytical Method/SOP Reference: DOE Method Sr-01/Sr-02 or equivalent/SOP RCHL-A-07, Rev 0

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	Daily	Absolute value less than analyte RL	a	Lab Manager	Accuracy	Absolute value less than analyte RL
LCS	1 per preparatory batch and or every 20 samples	Beta source check +/- 10% of known activity	b	Lab Manager	Accuracy	Beta source check +/- 10% of known activity
Carriers	Per sample	Sr and Yt carriers $\geq 40\%$ and $\leq 110\%$	c	Lab Manager	Accuracy	Sr and Yt carriers $\geq 40\%$ and $\leq 110\%$
Sample Duplicate	1 per preparatory batch and or every 20 samples	RPD $\leq 40\%$	d	Lab Manager	Precision	RPD $\leq 40\%$

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: NWT

Matrix: Sediment

Analytical Group: Gamma Isotopes

Analytical Method/SOP Reference: C1402-98 Standard Guide/SOP RCHL-A-05, Rev 1

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	Daily	Absolute value less than analyte RL	a	Lab Manager	Accuracy	Absolute value less than analyte RL
LCS	1 per preparatory batch and or every 20 samples	Gamma source check +/- 10% of known activity	b	Lab Manager	Accuracy	Gamma source check +/- 10% of known activity
Sample Duplicate	1 per preparatory batch and or every 20 samples	RPD \leq 40%	d	Lab Manager	Precision	RPD \leq 40%

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: NWT

Matrix: Sediment

Analytical Group: Alpha Emitting Radionuclides

Analytical Method/SOP Reference: DOE HASL-300 Method or equivalent/SOP RCHL-A-08, Rev 2

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	Daily	Absolute value less than analyte RL	a	Lab Manager	Accuracy	Absolute value less than analyte RL
LCS	1 per preparatory batch and or every 20 samples	Alpha source check +/- 10% of known activity	b	Lab Manager	Accuracy	Alpha source check +/- 10% of known activity
Tracer	Per sample	Th-229, U-232, Am-242, Pu-239, Ra-226, and Ra-224: 30-110%	c	Lab Manager	Accuracy	Th-229, U-232, Am-242, Pu-239, Ra-226, and Ra-224: 30-110%
Sample Duplicate	1 per preparatory batch and or every 20 samples	RPD \leq 40%	d	Lab Manager	Precision	RPD \leq 40%

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: Test America

Matrix: Sediment

Analytical Group: Strontium-90

Analytical Method/SOP Reference: EPA 905.0 Mod or DOE SR-03-RC Mod/SOP ST-RD-0403 Rev 7

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	b	Analyst	Accuracy	EPA 905.0 MOD: 69-137% DOE SR-03-RC MOD: 69-137% RPD \leq 40% and/or RER \leq 1
MS/MSD	As requested	Within in-house limits	d	Analyst	Accuracy/ Precision	EPA 905.0 MOD: 70-130% DOE SR-03-RC MOD: 70-130% RPD \leq 40% and/or RER \leq 1
Carriers	Per sample, blank, LCS, MS, MSD	Sr and Yt carriers \geq 40% and \leq 110%	e	Analyst	Accuracy	Sr and Yt carriers \geq 40% and \leq 110%
Sample Duplicate	1 per preparatory batch	RPD \leq 40% and/or RER \leq 1	b	Analyst	Accuracy	RPD \leq 40% and/or RER \leq 1

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: Test America

Matrix: Sediment

Analytical Group: Gamma Isotopes

Analytical Method/SOP Reference: EPA 901.1 Mod Gamma/SOP ST-RD-0102 Rev 5

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits (Limits are for tuna can ¹ LCS geometry until 250 mL Ra-226 geometry is active – Limits for Ra-226 listed are advisory until enough data points are generated to be statistically meaningful)	b	Analyst	Accuracy	Tuna Can ¹ : Cs-137: 94-118% Co-60: 90-110% Am-241: 90-110% 250 mL Poly: Ra-226: 70-130%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	b	Analyst	Accuracy	RPD ≤40% and/or RER ≤1

¹ Tuna Can: The laboratory's designation for a sealed source containing a known amount of radioisotope sealed within an impervious, protective container.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: Test America

Matrix: Sediment

Analytical Group: Isotopic Uranium, Alpha Emitter

Analytical Method/SOP Reference: DOE A-01-R Mod Iso-U/SOP ST-RD-0210 Rev 5

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	b	Analyst	Accuracy	U-234: 70-122% U-238: 69-119% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	d	Analyst	Accuracy/ Precision	U-234: 70-130% U-238: 70-130% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	e	Analyst	Accuracy	U-232: 30-110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	b	Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28 – Laboratory QC Samples Table for Sediment Samples (continued)

Lab: Test America

Matrix: Soil

Analytical Group: Isotopic Thorium, Alpha Emitter

Analytical Method/SOP Reference: DOE A-01-R Mod – Iso-Th/SOP ST-RD-0210 Rev 5

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits	b	Analyst	Accuracy	Th-230: 83-120% RPD \leq 40% and/or RER \leq 1
MS/MSD	As requested	Within in-house limits	d	Analyst	Accuracy/ Precision	Th-230: 70-130% RPD \leq 40% and/or RER \leq 1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	e	Analyst	Accuracy	Th-229: 30-110%
Sample Duplicate	1 per preparatory batch	RPD \leq 40% and/or RER \leq 1	b	Analyst	Accuracy	RPD \leq 40% and/or RER \leq 1

- Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.
- Reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.
- Truncate carriers/tracers above 100% recovery to eliminate low biased results. Re-prep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is nonconformance during sample preparation.
- Reprep and reanalyze the sample and duplicate in the associated preparatory batch for failed analytes if sufficient sample material is available and the sample is homogeneous. If RPD still out of range report as matrix interference confirmed and write a nonconformance. If reanalysis is in range re-extract samples in batch.
- There are no QC samples associated with gross alpha/beta analysis.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #29 - Project Documents and Records Table

Document	Where Maintained
Sampling and Analysis Plan	Project File
Work Plan	Project File
Health and Safety Plan	Project File
Field Data Collection Sheets	Project File
Field Logbook	Project File
Field Chain-of-Custody Records	Project File and Lab
Custody Seals	Project File
Air Bills	Project File
Communication Logs	Project File
Corrective Action Reports	Project File
Documentation of Deviation From Field Methods	Project File
Laboratory QA Plan	Laboratory
MDL Study Information	Laboratory
NELAP Accreditation	Laboratory
Sample Receipt and Tracking Records	Laboratory
Laboratory Chain-of-Custody Records	Laboratory
Equipment Calibration Logs	Laboratory
Sample Preparation Logs	Laboratory
Corrective Action Forms/Reports and Documentation of Corrective Action Results	Laboratory
Laboratory Data Reports including raw data	Project File and Lab
Data Summary and Instrument raw data for Field Samples, Standards, QC Checks, and QC Samples	Lab
Laboratory Internal Data Package Completeness Checklist	Lab
Case Narrative	Project File and Lab
Definition of Laboratory Qualifiers	Project File and Lab
Documentation of Laboratory Method Deviations	Project File and Lab
Laboratory Sample Identification Numbers	Project File and Lab
Signatures for Laboratory Sign-Off	Project File and Lab
Standards Traceability Records	Laboratory
Electronic Data Deliverables	Project File and Lab
Analytical Audit Checklists	Lab
Field Sampling Audit Checklists	Project File
Data Assessment Reports	Project File
Assessment Corrective Action Reports	Project File
Data Validation Reports	Project File
Hardcopy of the analytical data reports	NAVFAC Southwest Administrative Record (AR)
Hardcopy of the data validation reports	NAVFAC Southwest Administrative Record (AR)

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

SAP Worksheet #30 – Analytical Services Table

Matrix	Analytical Group	Sample Location/ID Numbers	Analytical Methods/SOP References	Data Package Turnaround Time	Laboratory (Name and Address, Contact Person and Telephone Number)	Backup Laboratory (Name and Address, Contact Person and Telephone Number)
Sediment	Radionuclides	<p>Sample IDs : Submarine Area / Screening survey: SA01 through SA10</p> <p>Berths North Screening survey: BN01 through BN18</p> <p>Berths South Screening survey: BS01 through BS12</p> <p>South Basin / Screening: SB01 through SB10</p>	<p>Gamma emitters: C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry /SOP RCHL-A-05</p> <p>Sr-90: DOE Method Sr-01/Sr-02 or equivalent/ SOP RHCL-A-07</p> <p>Alpha Emitters: Department of Energy (DOE) HASL-300 Method or equivalent / SOP RCHL-A-08</p>	15 business days	<p>Paul Wall, New World Technology Inc., 448 Commerce Way Livermore, CA, 94551 Paul Wall, 415-216-2731</p> <p>Lab POC: Tetra Tech 200 Fisher Ave San Francisco, CA 94124 Bill Dougherty 415-216-2731</p>	GEL Engineering, LLC 2040 Savage Road Charleston, SC 29407 843-769-7378 Joe Coffey, Ext. 4996

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #30 – Analytical Services Table (Continued)

Matrix	Analytical Group	Sample Location/ID Numbers	Analytical Methods/SOP References	Data Package Turnaround Time	Laboratory (Name and Address, Contact Person and Telephone Number)	Backup Laboratory (Name and Address, Contact Person and Telephone Number)
Sediment	Radionuclides	Sample IDs: 10% of samples will be analyzed by Test America	Test America Gamma Emitters: EPA 901.1 Mod Gamma/SOP ST-RD-0102 Rev 5 Sr-90: EPA 905.0 Mod or DOE SR-03- RC Mod Sr-90/SOP ST- RD-0403 Rev 7 Alpha Emitters: DOE A-01-R Mod Iso-U/SOP ST- RD-0210 Rev 5	20 business days	Ivan Vania, Test America, 13715 Rider Trail North, Earth City, MO, 63045 314-298-8566	GEL Engineering, LLC 2040 Savage Road Charleston, SC 29407 843-769-7378 Joe Coffey, Ext. 4996

Note: All analytical laboratories will be certified by NELAC and the State of California (where certification for the analyte is possible) and approved by the Navy.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #31 - Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Org.)	Person(s) Responsible for Responding to Assessment Findings (Title and Org.)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Org.)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Org.)
Internal Laboratory Assessment	Once per sample batch	Internal	NWT/Test America	QA Manager at NWT/Test America	Laboratory Director, NWT/Test America	Laboratory Director, NWT/Test America	QA Manager at NWT/Test America
Field Sampling Audit	Once at start of sampling	Internal	Battelle	Field Team Leader, Battelle	Project Manager, Battelle	Project Manager, Battelle	Field Team Leader, Battelle
Data Validation	Once per sample batch	External	Laboratory Data Consultants (LDC)	Data Validator, LDC	Project Manager, Battelle	Project Manager, Battelle	QA Officer, Battelle

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #32 - Assessment Finding and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Org.)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Internal Laboratory Assessment	Lab Report to detail project deviations	Paul Wall, Laboratory Director at NWT/ and Ivan Vania, Laboratory Director at Test America	within 5 days of sample analysis	Documented in the lab report	Greg Joyce, QC Program Manager at Tetra Tech/ and Marti Ward QA Director at Test America	2 weeks
Field Sampling Audit	Checklist to detail deviations from SAP	Eric Foote, Project Manager, Battelle	Once at start of sampling	Corrective action is documented in writing in the project records	John Hardin, Field Team Leader Battelle	3 days
Data Validation	Data Validation Report to detail deviations from SAP and project requirements	Eric Foote, Project Manager, Battelle	3 weeks after data submittal	Corrective action is documented in writing in the project records	Betsy Cutié, QA Officer, Battelle	1 week

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #33 - QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Sampling Audit	Once during sampling	9-19 Feb, 2009	Field Team Leader, Battelle	Project Manager, Battelle
Data Review Report	Once after all data generated and reviewed	19 Mar, 2009	QA Officer, Battelle	Project Manager, Battelle
Data Usability Report	Once after all QA management and data usability have been completed. The results of the Screening Survey will be included in the Data Gap Investigation Work Plan.	10 Apr, 2009	Project Manager, Battelle	Dane Jensen, BRAC PMO West; Laurie Lowman, Navy RASO Tom Lanphar, DTSC; Erich Simon, Water Board, Mark Ripperda, U.S. EPA, Vandana Kohli and Amy Brownell, Dept. of Public Health

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #34 - Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Org.)
Chain-of-Custody	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers. When the form has been verified, the reviewer will initial by the shipper's signature. A copy of the form will be retained in the project files, and the original will be placed inside the cooler for shipment.	Int.	Battelle Field Team Leader
Field Logbook	Field notes will be reviewed internally and placed in the project file.	Int.	Battelle Field Team Leader
Field Sampling Audit	At least one audit of the field activities will be conducted to assess compliance of activities with the SAP and to support data quality. The assessor will review sample collection, identification, handling and shipping procedures; equipment calibration, maintenance, and field data recording procedures.	Int.	Battelle Field Team Leader or Battelle QA Officer
Analytical Data Packages	All data will be subjected to a tiered review process before it is released from the laboratory. The first step is when the analysts review the quality of their work based on established guidelines. This includes reviewing and performing the following activities: (1) ensure that calibrations, tunes, blanks, and any other instrument QC criteria were met during the analysis reported; (2) ensure that calculations of individual analytes and detection limits were met; (3) verify that holding times or extraction times were met; and, (4) note any abnormalities that occurred during the analysis or any other QA/QC problems associated with the analysis. The second step is performed by a supervisor or data review specialist whose function is to provide an independent review of data packages. This person will verify that dates, sample identification, detection limits, reported analyte values, concentration units, header information, and comments were transcribed accurately. This person also will check to ensure that data that do not meet project objectives will be flagged with the appropriate data qualifiers. All information on the final data report that can be verified against the chain-of-custody will be checked for errors and completeness. The third step is done by the Laboratory Director or his designee who will sign the final reports. This person spot-checks activities associated with the log-in, tracking, extraction, sample analysis, and final reporting for technical and scientific soundness. The Laboratory QA Manager then will review 10% of all data packages to ensure that all QA requirements have been met. This person will ensure that the data package is consistent and complies with project requirements.	Int.	Laboratory Analyst, Laboratory Director and Laboratory QA Manager , NWT and Test America

SAP Worksheet #35 - Validation (Steps IIa and IIb) Process Table

Steps IIa/IIb	Validation input	Description	Responsible for Validation (name, org.)
IIa	Analytes	Ensure that the required analytes were reported as specified in methods, procedures or contracts.	Lab Manager, NWT and Test America Data Validator, LDC
IIa	Chain-of Custody	Examine traceability of the data from time of collection through reporting. Examine COC records against methods, procedures or contracts.	Lab Manager, NWT and Test America Data Validator, LDC
IIa	Sampling Methods and Procedures	Ensure that sampling methods were followed and any deviations were documented.	Battelle Field Team Leader
IIa	Sample Handling	Ensure that sample handling, receipt and storage procedures were followed and any deviations were documented.	Battelle Field Team Leader, Data Validator, LDC
IIa	Analytical Methods and Procedures	Ensure that the required analytical methods were used and any deviations were noted.	Lab Manager, NWT and Test America Data Validator, LDC
IIa	Data Qualifiers	Determine that laboratory data qualifiers were defined and applied as specified in methods and procedures.	Lab Manager, NWT and Test America Data Validator, LDC
IIa	Standards	Determine that standards were traceable and met the method requirements.	Lab Manager, NWT and Test America Data Validator, LDC
IIa	Step IIA Validation Report	Summarize deviations from methods, procedures or contracts. Include qualified data and explanation of all data qualifiers.	Lab Manager, NWT and Test America Data Validator, LDC
IIb	Sampling Plan	Determine whether the SAP was executed as specified (e.g. the number, location and type of field samples were collected and analyzed as specified in the SAP).	Battelle Project Manager, Battelle QA Officer
IIb	Sampling Procedures	Evaluate whether sampling procedures were followed with respect to equipment and sample handling (e.g. techniques, equipment, temperature, preservatives etc.)	Battelle Field Team Leader
IIb	Holding Times	Ensure that samples were analyzed within holding times specified in methods, procedures or contracts and any deviations were documented.	Battelle QA Officer, Data Validator, LDC
IIb	Field Duplicates	Compare results of field duplicates with criteria in the SAP and document any deviations.	Data Validator, LDC
IIb	Project Quantitation Limits	Determine that quantitation limits were achieved as outlined in the SAP.	Battelle QA Officer
IIb	Performance Criteria	Evaluate QC data against project-specific performance criteria (e.g. precisions, accuracy, representativeness, comparability, completeness and sensitivity).	Battelle QA Officer
IIb	Step IIb Validation Report	Summarize outcome of comparison of the data to method performance criteria in the SAP.	Battelle QA Officer

LDC: Laboratory Data Consultants

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

SAP Worksheet #36 - Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Sediment	Radionuclides	U.S. EPA CLP Functional Guidelines, LDC SOPs, NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, LDC
IIb	Sediment	Radionuclides	In accordance with NAVFAC SW EWI#1, and EPA Level III and IV guidelines	Data Validator, LDC, Battelle QA Officer

LDC: Laboratory Data Consultants

Note: Data Validation will be conducted according to the Navy's EWI #1. The validation strategy for this project is 80% Level III and 20% Level IV.

SAP Worksheet #37 -- Usability Assessment

The data quality assessment will be performed by project decision-makers. Key project personnel, including the Project Manager, Field Team Leader, and QA Officer, will evaluate the overall quality of the data to determine whether the sampling design performed as expected and whether the project decisions can be made with the desired level of certainty, e.g.:

- Are radionuclides currently present in sediment within Parcel F?
- What further action will be necessary to define the nature and extent of radionuclide concentrations in Parcel F Sediments to assess the threat to human health or the environment, or determine that site closure with no further action is appropriate?

This involves reviewing the analytical results and QA management reports while considering the specific questions outlined in Worksheet 10. Evaluation of the laboratory quality control samples will permit an estimation of analytical uncertainty. Evaluation of the matrix spike results will permit an evaluation of bias resulting from the sediment matrix.

The data quality assessment team will perform the following steps, using guidance contained in U.S. EPA QA/G-9R and U.S. EPA QA/G-9S.

1. Review the project objectives and sampling design defined during systematic planning to ensure they are still applicable and that assumptions were valid.
2. Review QA reports and conduct preliminary review of the data set.
3. Reconvene the project team to discuss the quality of the data and if the data set meets the project needs.
4. Make recommendations for further study, if needed.

In looking at the overall measurement error associated with this project, the data will be reviewed for precision, accuracy, representativeness, comparability, sensitivity, and completeness. If project-required measurement performance criteria are not achieved for these parameters, then it will need to be determined if the project data are usable to address the environmental questions asked in Worksheet 10. If the project data are not usable then it will need to be determined if re-sampling is necessary.

The usability of the data will be discussed in the QC summary of the DGI Technical Memorandum.

A variety of analytical and statistical control parameters will be used during analysis of samples to assess data usability. Analytical results will be evaluated by the project team in accordance with Precision, Accuracy, Representativeness, Completeness and Comparability (PARCC) parameters to ensure the attainment of the project-specific DQOs. Of these PARCC parameters, precision and accuracy will be evaluated through the collection of the QC samples listed in Worksheet 20. Precision and accuracy goals for these QC samples are listed in Worksheets 12 and 28.

Contract Laboratory QC Check Samples

Laboratory QC samples consist of method blanks, laboratory control samples (LCSs), matrix spike/matrix spike duplicates (MS/MSDs), surrogates, and laboratory duplicates. Samples will be spiked with surrogate compounds where required by the method or if the Navy, Battelle, and the analytical laboratory determine further investigation is required.

Detection and Quantitation Limits

From the Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), the MDA can be calculated as a sample-specific value. Typically, these values assumed both a Type I (α) and Type II (β) error of 5%. However, for project samples analyzed at the on-site and off-site laboratories, the project will utilize the MDL in calculations regarding MDA for gamma spectroscopy results. For purposes of and in discussions regarding gamma spectroscopy, any use of the term “MDA” will specifically describe the sample-specific MDL.

The MDL is an estimate of the measured concentration at which there is 99% confidence that a given analyte is present in a given sample matrix. The MDL is the concentration at which a decision is made regarding whether an analyte is detected by a given method. The MDL can be calculated from replicate analyses of a matrix containing the analyte and is functionally analogous to the “critical value” or the “limit of detection”.

For project sample results, gamma spectroscopy analysis software will utilize a mathematical model that ensures that the reported sample-specific MDA values are equivalent to the sample-specific MDL. Project decisions, in concert with the reported measurement results, can be made using the MDL.

The project quantitation limit is determined by project objective (e.g., cleanup goal) or technical limitations (e.g., three to five times the MDL). Worksheet #15 compares the PQLs to the PALs.

Precision

Precision is defined as the degree of mutual agreement between individual measurements of the same property under similar conditions and provides a measurement of the reproducibility of an analytical result. Precision will be evaluated through the analysis of field duplicate samples, LCS and LCS duplicate (LCSD) (if LCSD is run), and MS/MSD samples (Worksheet 20). Field duplicate samples typically will be collected at a frequency of one duplicate per 10 samples (Worksheet 20). Relative percent difference (RPD) criteria are specified in Worksheet 12. QC criteria failures will be documented in the laboratory report. The affected data will be qualified as described in the U.S. EPA National Functional Guidelines, and the impact of the QC failures on the DQOs will be assessed in the DGI Technical Memorandum.

Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as an RPD according to the following equation:

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where:

A	=	First duplicate concentration
B	=	Second duplicate concentration

The precision data obtained from the results of QA/QC samples allow an approximation of the uncertainty of the analytical results.

For this project, the goal for precision of field duplicates has been set at less than 50 percent RPD, as shown in Worksheet 12.

Laboratory analytical precision is also evaluated by analyzing MS/MSDs. The laboratory will have experimentally derived acceptance limits for RPDs established for each analytical method. The laboratory will ensure that internal QC sample results lie within acceptance limits.

Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, or analytical techniques. Accuracy will be evaluated by the percent recovery of the spiked compounds in the LCS/LCSD, and MS/MSD samples. LCS and MS samples will be spiked prior to extraction with the method target compounds indicated in this SAP. MS/MSD and LCS/LCSD samples will be analyzed at a frequency of 5 percent. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy using the following equation:

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where:

S	=	Measured spike sample concentration
C	=	Sample concentration
T	=	True or actual concentration of the spike

Worksheet 28 presents accuracy goals for this investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

For MS and MSD, sample heterogeneity often negatively affects the accuracy and precision of the analysis. Also, the presence of high levels of target compounds in the sample chosen for spiking may necessitate a dilution of the sample, or may otherwise result in errors in spike compound recovery. For these reasons, MS/MSD samples may not be truly representative of the accuracy and/or precision of the analytical process.

If MS/MSD analyses do not meet the specified recovery criteria, the recoveries from the LCS will be evaluated. If the LCS accuracy criteria are met, the failure of the MS/MSD will be attributed to interference from the sample matrix, and no corrective action will be required. If the LCS accuracy criteria are not met, the associated primary and QC samples will be re-prepared and re-analyzed.

In cases where re-preparation and re-analysis of the samples is not possible, the QC criteria failures will be documented in the case narrative and included in the final report. The affected data will be qualified and the impact of the QC failures on the DQOs for the project will be assessed in the final report.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population; variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be

obtained through proper collection and handling of samples to avoid interference and minimize cross-contamination.

Representativeness of data will also be ensured through consistent application of the appropriate established field and laboratory procedures. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Laboratory procedures will be reviewed to verify that SOPs were followed and method requirements were met during the analysis of project samples. Laboratory sample storage practices, holding times, sub-sampling procedures, method blanks, and evidence of matrix interference will be assessed for potential impacts on the representativeness of the data. Data determined to be non-representative will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

Representativeness as it relates to field procedures refers to the collection of samples that allow accurate conclusions to be made regarding the composition of the sample media at the entire site.

Representativeness will be qualitatively assessed by evaluating whether the procedures described in this SAP were followed. The site-sampling layout, including sampling locations, frequency of sampling, and timing of sampling activities, will be reviewed.

Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with the QC procedures outlined in this SAP and when none of the QC criteria that affect data usability is exceeded. When data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The evaluation of completeness will help determine whether any limitations are associated with the decisions to be made based on the data collected.

Completeness will be evaluated by reviewing the tasks that contribute to the sampling event, such as chain-of-custody procedures and adherence to this SAP. The QC parameters to be evaluated in determining completeness include: holding times, ICALs, continuing calibrations, surrogate recoveries, LCS recoveries, MS/MSD recoveries and RPDs, and laboratory duplicate RPDs. The completeness goal for this project is 95%.

Comparability

Comparability expresses the confidence with which one data set can be compared with another.

Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Analytical methods selected for this field investigation are consistent with the methods used during previous investigations of this type.

To ensure the comparability of laboratory data, the laboratory will use standard test methods and means of sample preservation; standard units, detection limits, calculation procedures, and reporting formats; and standard measures of accuracy and precision.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

REFERENCES

National Oceanographic and Atmospheric Administration (NOAA). 2005. NOAA Home Page. Available at: www.ncdc.noaa.gov/oa/climate/online/ccd/nrmppcp.txt.

New World Technology (NWT). 2002. *New World Technology Phase V Studies*. Scoping and Characterization Surveys, Soil and Other Media Sampling Programs, Remediation Studies, and Final Status Surveys, January.

San Francisco Bay Regional Water Quality Control Board (SFRWQCB). 2007. San Francisco Bay Regional Water Quality Control Board San Francisco Bay Water Quality Control Plan (Basin Plan). San Francisco, CA, January 18.

Tetra Tech EC Inc. 2008. *Final Sampling and Analysis Plan for Basewide Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California*. May.

United States Environmental Protection Agency (U.S. EPA). 1989. (HRA-2951) *Radiological Survey of the Mare Island Naval Shipyard, Alameda Naval Air Station, and Hunters Point Shipyard*. June 1.

United States Environmental Protection Agency (U.S. EPA). 2002. *Method 5035A: Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples*. July.

United States Environmental Protection Agency (U.S. EPA). 2005. *Polychlorinated Biphenyl (PCB) Site Revitalization Guidance under the Toxic Substances Control Act (TSCA)*. November.

US Navy 1999. *Historical Radiological Assessment; Hunters Point Annex; Volume I; Navy Nuclear Propulsion Program; 1966-1995*.

US Navy 2004. *Historical Radiological Assessment, Volume II, Use of General Radioactive Materials, 1939-2003, Hunters Point Shipyard*.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

ATTACHMENT A:
Summary of HRA Information

Site Background

The Historical Radiation Assessment for Hunters Point (US Navy, 2004) provides a very comprehensive site history. Refer to the HRA for additional source information and details. The document is large, the information is presented here applies both directly to Parcel F and indirectly from buildings of concern with potential sources of radionuclide particle transport through run off and storm drains into Parcel F. Other HRAs are referenced in this Attachment. The Final HRA, and the other HRAs referenced here and in the Final HRA can be accessed at the Navy's web portal:

https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_navfacsw_pp/environmental/hps-hra

HPS is situated on a peninsula in the southeast corner of San Francisco, CA. The peninsula is bounded on the north, east, and south by San Francisco Bay and on the west by the Bayview Hunters Point district. HPS comprises about 955 acres, with approximately 400 acres of offshore sediments. From 1945 to 1974, the Navy used HPS predominantly for ship repair and maintenance. HPS was deactivated in 1974 and remained relatively unused until 1976, when it was leased to Triple A Machine Shop, a private ship repair company. In 1986, the Navy resumed occupancy of HPS. The Base was closed in 1991. This study is being performed to address data gaps that exist in the quantification of the nature and extent of radioactive contamination within the offshore sediments of Parcel F.

Site History

In 1850, the Hunters Point peninsula was approximately 6,000 feet long and 2,000 feet wide, with a maximum elevation of 290 feet. The peninsula sheltered a relatively deep anchorage on the protected side of the Bay. The first drydock at Hunters Point was completed in 1868. That drydock facility was privately owned and used by both commercial shipping customers and the Navy.

In 1903, a second drydock was built at Hunters Point. At the time, it was the largest drydock on the West Coast. Between 1909 and 1939, the facilities at Hunters Point were owned and operated by a Bethlehem Steel Company subsidiary and used extensively for commercial and military ship maintenance and repair. In the 1930s, the Navy recognized the need for additional ship repair facilities on the West Coast because Mare Island Naval Shipyard, the only Navy shipyard in the Bay area, had a shallow anchorage and limited room for expansion. In 1939 the Navy contracted with Bethlehem Steel to purchase the Hunters Point facilities.

After the 1939 purchase, the Navy leased the facilities to Bethlehem Shipbuilding and Drydock Company to operate the shipyard for three years. However, in light of pending military actions, the Navy terminated Bethlehem's lease in October 1941 and took full control of Hunters Point on 18 December 1941, 11 days after American entry into WW II. Significant improvements and construction began immediately to support the war effort. The Navy began excavation of the hills surrounding the yard, using the resulting spoils to expand the shoreline into the Bay. Quays, docks, and support buildings were built on an expedited wartime schedule to support the yard's mission of fleet repair and maintenance. A major expansion on the north side of the shipyard occurred during 1942 and 1943 when a submarine servicing facility consisting of drydocks and industrial and barracks buildings was completed.

Over 40 percent of the buildings at HPS were built during WW II. However, despite the intensive construction and facility expansion, the shipyard serviced 209 ships and constructed four during the war for a total of 213 “dockings”.

A unique WW II support function of HPS was the loading of components of the atomic weapon “Little Boy” that was eventually used on Hiroshima. This item was loaded on the United States Ship INDIANAPOLIS on at 2:00 pm on 15 July 1945, and is reported to have contained half of the uranium-235 (U-235) available in the United States, valued at the time at \$300 million.

Immediately after the end of WW II, the Navy used the expansive berthing facilities at HPS for reserve fleet ships returning from the Pacific. In 1946, this berthing was interrupted by the return of the Navy target and support ships from OPERATION CROSSROADS, two atomic tests conducted at Bikini Atoll in the South Pacific. The return of these ships resulted in the creation of a special radiation safety office and program to manage the contaminated vessels. The reserve fleet returned to HPS after work with the ships from OPERATION CROSSROADS was completed. By 1951, HPS shifted from operating as a general repair facility to specializing in submarine maintenance and repair. However, the Navy continued to operate Pacific Fleet carrier overhaul and ship maintenance repair facilities at HPS through the 1960s. Use of the shipyard began to decline steadily in the late 1960s and early 1970s because the Navy began using private shipyards to do work it had normally done in its own yards. As more work went to private yards, the primary mission of HPS continued on a diminishing basis until 1974 when the yard was disestablished as an active naval facility.

Refurbishment and Handling of Radioluminescent Devices

Beginning in the late 1930s and continuing through the WWII years, radioluminescent devices and paint came into wide use in the Navy. These devices constituted the first G-RAM introduced to HPS. Instrument dials and surfaces that needed to be illuminated without using electricity were coated with a radioluminescent compound or paint containing Ra-226. Use of radioluminescent devices was common throughout Navy ships and the shipyard. Historical research has not clearly established the location of the radium paint shop at HPS. However, Building 253, completed in 1947, has been described as the Electronics and Optical Shop. Buildings 253 and 366 are associated with other radiological operations and have been identified as containing paint shops after 1949. In view of the type of operations conducted in Buildings 253 and 366, it is likely that radioluminescent paint was used in those buildings.

In the late 1960s, the Navy began to implement stricter controls over the use of radium (HRA-2931; HRA-2932). Radioluminescent devices containing radium were gradually phased out of the Navy programs, but records indicate that they were in use through at least 1971.

Starting in the early 1950s, other radionuclides, including Sr-90, H-3, and Pm-147, were used in radioluminescent devices. Sr-90 was primarily used in deck markers onboard ships. H-3 and Pm-147 were commonly used in diver’s equipment, watches, and compasses. Although no specific documentation has been discovered, it can be reasonably assumed that control and disposal of these devices would have been done in a manner similar to those for radium devices because they were general commodity items and not controlled as radioactive waste.

Disposal of radioluminescent devices was not controlled by specific procedures until the late 1960s. Prior to that time, it was common practice throughout private industry and the military to dispose of radioluminescent instruments and articles by burial in landfills. Although no direct reference to burial at HPS was discovered during record searches, there are sufficient survey data and secondary

reference materials to substantiate that this was the practice. Additionally, liquid waste containing radium was commonly disposed of via building drain systems to sewers. It was also common practice to leave radioluminescent devices in place on equipment when it was sent to the salvage or scrap yard or processed through smelters.

Of the radionuclides used in radioluminescent devices, those still of concern are Ra-226 (1,599-year half-life) and Sr-90 (28.78-year half-life). H-3 (12.33-year half-life) would be of small concern since it is a gas and would most likely have dissipated by this time. Because of its short half-life (2.6 years), Pm-147 is not a radionuclide of concern at HPS. HPS sites that could have been impacted by the refurbishment, disposal, or processing of equipment with radium devices are the HPS Landfill Area (IR-01/21); HPS Bay Fill Area (IR-02); Former Oil Reclamation Ponds Area (IR-03); HPS Scrap Yard (IR-04); HPS Salvage Yard (IR-12); the HPS Smelter (Building 408); and Buildings 146, 253, and 366. Building 146 was identified as a collection point for devices containing radium (HRA-2811; HRA-2829). Storm, sewer, and drainage systems associated with buildings where radium paint was used are also potentially impacted.

Gamma Radiography

From the 1940s through the 1960s at HPS, a non-destructive testing technique using a radioactive source, gamma radiography tests metals and welds similar to the way x-rays do diagnostic studies on humans. The earliest devices for gamma radiography in industry and at HPS used Ra-226 sources. By the mid-1950s, Ir-192, Cs-137, and Co-60 sources were also being used for gamma radiography. Use of Ir-192, Cs-137, and Co-60 sources and associated gamma radiography equipment was authorized by specific AEC Byproduct Material Licenses after 1954. Ra-226, a naturally occurring radionuclide, was not controlled by the AEC. The AEC licenses defined requirements for the use, testing, storage, and transport of the gamma radiography sources, which were closely monitored and controlled. Radioactive sources, including those in radiography devices, were found to leak radioactivity occasionally. Correcting the leak required return of the source to the manufacturer or disposal by regulated means. There is historic evidence of sources being repaired, resurveyed, and placed back into service. There is no specific information as to whether cleanup actions were required or performed following the discovery of leaking sources, but leaking conditions were reported to the AEC.

In addition to gamma radiography, x-ray radiography was a method used at the shipyard. X-ray radiography used an x-ray machine to generate penetrating radiation instead of a gamma-emitting radionuclide. The significant difference for the intent of the HRA (US Navy, 2004) is that x-ray machines do not create or use G-RAM and do not cause materials to become radioactively contaminated.

Gamma and x-ray radiography were commonly performed onboard ships and in buildings. Examples of specific sites where radiography equipment and sources were used, stored, and maintained include Buildings 113A, 146, 157, 214, 253, 351A, and 411. At the time of shipyard closure, all licensed gamma radiography sources and cameras were transferred to other licensed facilities or disposed of as radioactive waste at licensed disposal facilities.

Instrument Calibration

The shipyard used radiation detection instruments (commonly called Radiation Detection, Indication, and Computation instruments or "RADIAC" by the Navy) to monitor levels of and exposure to radiation. The use of these instruments was essential to the use of gamma or x-ray radiography equipment,

decontamination efforts, and personnel monitoring as they were used to set up appropriate barriers to keep personnel away from radiography areas, confirm decontamination results, and monitor personnel exposures. The shipyard maintained and calibrated its own inventory of RADIACs. In the early days of RADIAC use (the late 1940s and early 1950s), instrument calibration was done using a radioactive source in a lead-shielded container commonly referred to as a “pig.” Calibration points were at measured distances from the pig with the door of the pig open to expose the source. An area on a floor would be painted to mark the levels a RADIAC should read at specific distances from an exposed source. To calibrate an instrument, a technician would place it at the required calculated distance, open the door of the pig, and adjust the instrument to read the appropriate radiation level. As of this writing, the remains of calibration distance markings can still be seen on the third floor of Building 253, although the source and its pig are gone. Specially designed calibrators replaced the primitive use of a source in a pig as technologies improved. These calibrators used various sealed sources, primarily Cs-137, Co-60, plutonium-239 (Pu-239), or Th-232, in specially designed shielded assemblies. These sources were licensed by the AEC and were routinely checked for leakage of radioactivity. If leakage was found, the calibrator would be removed from service until the source was repaired or replaced. If a source could not be repaired, it was disposed of as radioactive waste. All sources were either transferred to other licensed users or disposed of offsite as radioactive waste when the shipyard closed. The AEC licenses held by the shipyard for the calibrators are detailed in Section 5.0. Available records indicate that calibration facilities used by the shipyard were maintained in Building 253. Small check sources were available for checking the proper operation of RADIACs in the field. These were usually small sealed sources of a certified quantity of radioactive material, generally called check sources. Radionuclides commonly used for check sources were Cs-137, Co-60, Ra-226, and Th-232. Some of the check sources were maintained with the RADIAC and some were contained in source sets that allowed users to check the instrument for response to different types of radiation and the accuracy of that response. Most of the check sources did not require AEC licensing. These sources were disposed of offsite as radioactive waste when they were no longer useful.

Decontamination of Ships

The drydock facilities of the shipyard were used in the late 1940s for decontamination of OPERATION CROSSROADS ships and periodically through the 1950s and 1960s for the decontamination of ex-GRANVILLE S. HALL (Miscellaneous Auxiliary Service Craft [YAG]-39) and ex-GEORGE EASTMAN (YAG-40). YAG-39 and YAG-40 were ex-Liberty ships specially modified to Naval Radiological Defense Laboratory (NRDL) specifications to provide support for research during weapons tests in the Pacific. These vessels were decontaminated by the shipyard work force under the direction of NRDL. The details of OPERATION CROSSROADS decontamination efforts are detailed below.

History of Operation Crossroads at HPS

To determine the effect an atomic weapon detonation would have on ships and personnel and to aid in the development of defensive measures to protect the fleet, the Navy made plans during late 1945 and early 1946 to test atomic weapons. This testing, organized and carried out under the command of Joint Task Force One (JTF-1), was given the code name OPERATION CROSSROADS. The conduct of OPERATION CROSSROADS and the resultant decontamination of ships that participated in the tests had a significant effect upon HPS. OPERATION CROSSROADS occurred in July 1946, when JTF-1 detonated two Nagasaki-sized atomic bombs in the lagoon of Bikini Atoll in the Marshall Islands. OPERATION CROSSROADS consisted of two detonations: one air burst (Shot Able) on 1 July 1946, and one underwater burst (Shot Baker) on 25 July 1946. JTF-1 staged target ships at predetermined locations in the Bikini lagoon so the effects of the detonations could be evaluated. Many of the target vessels were committed to destruction or heavy damage by their placement during the test. Support ships

were staged at distances that were estimated to be safe from the effects of the detonation but close enough to record the detonations and gather scientific data. The Shot Able airburst caused extensive damage to many of the target ships. However, the detonation was nearly 0.5 mile from its intended target, the brightly painted battleship ex- NEVADA, and this affected the expected results. While damage to vessels near the blast was serious, the airburst did not generate much radioactive debris, sparing the ships from being heavily contaminated with radioactivity. Shot Baker, the underwater burst, was far more damaging radiologically. A cable suspended the bomb approximately 60 feet under a specially modified barge. This setup ensured that the weapon would detonate on target. While extensive damage was expected from the detonation, the severity of radiological effects was not anticipated. The first effect of the blast was a tremendous bubble of water and steam that broke the ocean's surface. Then a huge wave, over 90 feet high, later called a base surge, rolled over target and support vessels as well as the islands of the atoll. Vast quantities of radioactive debris, primarily consisting of fission products (radioactive elements resulting from the fission, or splitting, of the bomb's plutonium), unconsumed plutonium from the bomb's fissioning core, and radioactive sand and coral that had been irradiated by the intense neutron radiation from the blast rained down on the target and support ships, islands, and lagoon. This unexpected outcome caused contamination of both target and support ships, the extent of which depended on each ship's position relative to the zero point of the blast. Twelve of the ships in the immediate area of the detonation sank immediately or within hours. While support ships were affected by the base surge, the main source of contamination of the support ships was the contaminated waters of Bikini lagoon when the ships entered the lagoon to monitor or work on the target ships and processed the contaminated water through the ships' systems. The heavy contamination of the remaining target ships and the subsequent contamination of the support vessels presented the Navy with an unplanned and unprecedented problem: the decontamination of hundreds of ships. Decontamination experiments were initially carried out at Bikini. These efforts primarily focused on the weather decks, underwater portions of the hull, saltwater systems, and evaporators. Evaporator systems had particularly high concentrations of fission products and plutonium. Even though ships' evaporator systems had been shut down for the test, a command decision to operate the evaporators in the contaminated lagoon to generate fresh water resulted in the systems becoming contaminated. The remoteness of the test site, the lack of trained personnel and radiation monitoring equipment, and the extensive contamination caused lengthy delays, jeopardized the scientific purposes of the operation, and left the Navy with a fleet of ships incapacitated by radioactivity. Initially thought only to be contaminated with beta and gamma radiation from the fission products, the discovery of alpha contamination from the plutonium on the ships also caused the CNO and the BUMED a great deal of concern for the safety of Navy personnel working on the contaminated ships. When it became apparent that radiological conditions at Bikini were hampering decontamination efforts, JTF-1 requested relocation of the primary decontamination effort. The CNO instructed the JTF to move decontamination operations to Kwajalein Atoll. Safe, or clearance levels, and decontamination procedures for the ships were debated and finally issued through BUSHIPS (HRA-2641). The most heavily contaminated ships were sunk at Kwajalein, where surviving target ships and support vessels underwent preliminary decontamination. In short order, the Navy determined that shipyard facilities would be required to provide the necessary support and equipment to complete such a large-scale decontamination effort. The Navy also realized that expertise would be needed to develop methodologies to remove the contamination successfully. The Navy chose HPS as the principal location for the decontamination of OPERATION CROSSROADS ships because Navy technical knowledge in radiological science was centered there and the site was close to scientific expertise at the University of California at Berkeley and Stanford University.

Once the Navy determined that a shipyard environment would be needed, the target and support ships were returned to west coast ports. During the return, the ships' force continued decontamination efforts, disposing of removed contaminated materials at sea. These efforts included attempts to decontaminate saltwater systems, but only marginal success was achieved. The most heavily contaminated ships were

ordered to proceed to HPS. These ships were anchored at various locations in the Bay while experimental decontamination studies were performed by the RADLAB. These studies included determining health effects and radiation tolerance levels for personnel decontaminating the vessels, exploring methods to measure contamination and decontamination effectiveness, and investigating the most effective decontamination techniques. Eighteen target ships and 61 support ships returned to HPS. A listing of all OPERATION CROSSROADS ships is provided in the HRA, Table 6-2 (US Navy, 2004).

Uptake of radioactivity in the marine growth on the hulls and contamination of the saltwater piping of the ships were the most significant areas of contamination. Hull decontamination was performed in drydock, primarily using wet sandblast techniques. Saltwater piping was cleaned using various acid solutions. Initially, the sand and acid solutions were collected for disposal at sea. Sea disposal was defined as dumping at sea beyond the 100-fathom (600-foot) contour. However, a BUSHIPS conference, held on 27 November 1946, concluded that "Special disposal of sand used in sandblasting underwater bodies of radioactive contaminated nontarget ships is not required, provided marine growth is removed first and disposed of. Solutions used in removal of radioactivity from saltwater systems of nontarget ships may be discharged into harbors, preferably at a slow rate or after dilution, without security or health hazard." Based on the experience at HPS and the recommendations from the conference, JTF-1 issued a message on 4 December 1946 with the following guidance:

- Wet sandblast media used for the decontamination of underwater bodies of nontarget vessels did not require special disposal.
- Sea disposal was required for marine growth and scale removed at first drydocking and scale and marine growth removed manually from evaporators and saltwater systems.
- Decontaminating solutions, including acids, used in cleaning saltwater systems could be discharged into the harbor. This was to be done during ebb tide well clear of docks and shorelines at a slow rate or by providing a flow of water so as to dilute the solutions by one-fourth.

Three of the towed target ships presented a special problem for the Navy; ex-INDEPENDENCE, ex-GASCONADE, and ex-CRITTENDEN contained radioactively contaminated fuel oil. This may have occurred on other ships that came back under their own power but the fuel would have been burned during the voyage back to HPS. The fuel oil of the three target ships was contaminated with low levels of plutonium and mixed fission products. Approximately 610,000 gallons of contaminated fuel oil from the ships was subsequently burned in the shore power/steam plants at HPS. It is likely that the fuel was burned in the shipyard boilers in Buildings 203 and 521. Historical documentation of radioactivity content in the fuel was only found for ex-INDEPENDENCE. Calculations based on information contained in these documents show that the concentration of plutonium in the exhaust from the power plants would have been approximately 3.99×10^{-12} microcuries per cubic centimeter ($\mu\text{Ci/cc}$). This concentration was less than 10 percent of the 1947 AEC tolerance level of $6.77 \times 10^{-11} \mu\text{Ci/cc}$ for exposure of a worker based on working 10 hours per day, 6 days per week for 1 year. The fission product activity concentration in the ex-INDEPENDENCE fuel was given as a gross number, $7.2 \times 10^3 \mu\text{Ci}$ in 274,000 gallons, so a direct comparison with individual radionuclide limits is not possible. The total airborne concentration due to fission products during the burning of the fuel oil is calculated to be $7.13 \times 10^{-10} \mu\text{Ci/cc}$. Radioactive contamination from the burning of fuel oil is not considered a primary source of contamination of sediments within Parcel F.

As part of the final clearance process, it was also necessary to remove contaminated materials and equipment from the ships undergoing decontamination. Procedures that defined the clean limits for final clearance of the ships also applied to materials and equipment removed from them. Detailed radiological surveys were performed and reviewed to ensure these limits were not exceeded. Control of the materials

prior to monitoring was important to the shipyard and control of contamination was of concern to the Navy. The materials were monitored on the ships and at dockside after removal from the ships, prior to release for reuse. No information has been found on release surveys from areas adjacent to the berthing spaces that contained removed contaminated materials.

By January 1947, 80 non-target ships had been granted final clearance. By the end of February 1947, the status of all OPERATION CROSSROADS non-target ships, including those at HPS, was:

Ships with final clearance	128
Ships with operational clearance awaiting final clearance	4
Ships with operational clearance but requiring further work	3
Ships with neither clearance	22
Ships destroyed following test Baker	2

Eight ships remained at HPS to be decontaminated after December 1947. No details are available regarding the date that the final decontamination work was completed, but no mention of OPERATION CROSSROADS ships, other than ex-INDEPENDENCE, is found in available historical records after 1948. Further history of ex-INDEPENDENCE at HPS is detailed in Section 6.3, History of the NRDL.

Table 6-4 in the HRA (US Navy, 2004) lists the sites at HPS that were impacted by work associated with OPERATION CROSSROADS.

Non-Licensed Radioactive Commodities

Additional radioactive materials were commonly used throughout the shipyard in commodity items. These items include smoke detectors (Am-241), exit signs (H-3), electron tubes (variety of radionuclides), night vision equipment (Th-232), and thoriated tungsten welding rods (Th-232). Safety devices (smoke detectors and exit signs) remain in shipyard buildings today.

Triple A

From 1976 through 1986, major portions of the shipyard were leased to Triple A, a shipbuilding and repair company. Triple A did not possess radioactive materials licenses and likely subcontracted operations that required the use of licensed materials, such as gamma radiography (HRA-2909). It is possible, based on the time period of Triple A operations, that shipboard devices containing Ra-226 and/or Sr-90 were removed and disposed of at the shipyard by Triple A. No historical documentation has been found that details Triple A radiological operations at the shipyard. Though their lease expired in December 1986, Triple A did not vacate the shipyard until March 1987. During its tenure at the yard, Triple A sublet various buildings and grounds to a variety of individuals and businesses. Sublease agreements for building use with Triple A tenants remained in force after the Navy reclaimed the property in 1987.

Naval Radiological Defense Laboratory

In 1946 the navy created the Radiological Safety Section (RSS); the RSS was tasked with applying radiological safety within the Navy. The Navy selected HPS as the site for the RSS partially due to the proximity of the University of California at Berkeley and Stanford University, two major research universities with experience in experimental physics. The RSS also became known as the RADLAB. The RADLAB developed decontamination methods for OPERATION CROSSROADS ships. This task included extensive research and experimentation on decontamination methods, personnel protection, and

development of radiation detection instrumentation. By 1950, NRDL occupied ten buildings at HPS: Buildings 224, 313, 313A, 322, 351, 506, 507, 508, 510, and 701. The laboratory mission was expanded to beyond the basic and applied research in radiation effects on materials, vessels, and personnel to include further development of defensive measures for ships, personnel, and shore installations.

The carrier ex-INDEPENDENCE was retained for use by the RADLAB and subsequently by NRDL for experimentation, testing of decontamination methods, storage of radioactive wastes, and as a dockside laboratory. In 1950, ex-INDEPENDENCE was docked at Berths 16 and 17 at the Regunning Pier (more commonly referred to as the Gun Mole), where NRDL had a field laboratory that managed work on the carrier. This field laboratory eventually included a converted barge (YFNX-16), a decontamination pad, and personnel clothing change and decontamination facilities. Ex-INDEPENDENCE, loaded with radioactive waste from NRDL and other generators, was towed to sea and sunk in January. NRDL's barge and decontamination facilities remained on the Gun Mole until at least 31 December 1958.

Two ex-Liberty ships, YAG-39 (ex-GEORGE EASTMAN) and YAG-40 (ex-GRANVILLE S. HALL), were specifically modified through the period 1952 to 1955 to support and study the effects of atomic and nuclear weapons. The primary mission for them while assigned to NRDL was on-scene support and research during weapons tests in the Pacific. As was experienced with OPERATION CROSSROADS ships, the YAGs became radioactively contaminated when they were used at weapons tests. They returned to HPS for decontamination, modification, repair, and storage when they were not in use. Documents indicate that decontamination operations were calculated with controls defined and imposed. A concentration limit for liquids of 1×10^{-5} $\mu\text{Ci/cc}$ "*specific activity*" (no definition of radionuclides) was imposed. Sandblast material was to be controlled (collected and drummed as radioactive waste) during removal of "hot spots" (not further defined). Once the hot spots were removed, the remaining sand could be disposed of in the Bay. By 1956, a new directive regarding the disposal of liquids and sandblast material into the Bay stated that decontamination was to be "*witnessed by shipyard personnel to prevent runoff of contaminated liquids or dumping of contaminated wastes into bay waters at dockside. All contaminated wastes shall be disposed of in accordance with existing regulations*".

The YAGs were used for the basic mission of research and weapons test support through the late 1960s. YAG-40 was sold commercially in 1972, and YAG-39 was stricken from active service in 1975. Other ships returned to HPS for decontamination following participation in weapons testing. An example would be the USS KILLEN, a target ship that returned to HPS following participation in OPERATION HARDTACK I. No specific records were located documenting the number of ships nor their locations while at HPS. However, it is assumed that the same decontamination standards and practices were employed as those used for the YAG-39 and 40.

Radionuclide Use and Control

Because of the breadth of the research performed, NRDL used a large number of radionuclides.

The use of radium was an exception to the licensing requirement because radium was not regulated by the AEC but was controlled by the Navy. A complete listing of radionuclides used by the laboratory is included in Table 4-2 of the HRA (Navy 2004). NRDL was a pioneer in the development and use of radiation sources. The laboratory needed known radioactive sources to calibrate RADIACs and dosimetry devices such as film badges and pocket dosimeters. They used various sources for animal studies to simulate fallout and other tests and experiments. Most of these sources were short half-lived (less than 3 year half-life), but some had relatively long half-lives (for example, Ra-226, 1,599 years). Because these source materials were not sealed and were manipulated in the laboratory, they were subject to occasional spills. The Health Physics group maintained tight controls over these radioactive materials. Spills were

decontaminated and material accountability maintained. Sealed sources, purchased from AEC-qualified vendors, were relatively easy to control. These sources were routinely tested to detect leakage. If leakage was found, the source was returned to the vendor for repair or replacement, or disposed of as radioactive waste. When NRDL closed in 1969, remaining sealed sources either were returned to the vendor, sent to another Navy facility licensed for receipt, or disposed of as radioactive waste at an off-site, licensed disposal facility.

From the beginning, NRDL occupied many buildings at the shipyard. In March 1955, most of the NRDL's 600 staff members moved to Building 815, which had been specifically designed and constructed for NRDL. After moving from buildings it formerly occupied, NRDL personnel surveyed them for residual radioactive materials. Surveys were done in Buildings 142, 224, 313, 313A, 322, 351, 351A, 366 (formerly known as 351B), 507, 508, 510, and 520. NRDL reviewed survey results and cleared these buildings prior to returning them to the shipyard once they met the release requirements of the period. The HPS buildings used by NRDL are listed in Tables 6-5A (through 1955) and 6-5B (after 1955) in the HRA (Navy 2004). In some cases, for example Building 506, restrictions were placed on future activities, such as drain line removal and replacement, indicating there was concern that not all radioactive materials were recovered or removed. Building 815 was designed with laboratory operations defining the parameters for construction. Ventilation systems were filtered to preclude releases of airborne radioactive contaminants from the building to the environment. Source storage facilities were provided in the basement. Two 15,000-gallon underground liquid effluent holding tanks were located outside the building. Discharges of potentially radioactive liquid were captured in these tanks and tested to ensure they met contemporary release limits prior to discharge. Radioactive sources and samples used by individual laboratories were placed in heavily shielded and locked rooms within the building known as "caves". Additional support facilities were constructed in the period following the move to Building 815. A Co-60 irradiator was installed and used in the hot cell in Building 364 for animal experimentation. The consolidation of activities in Building 815 did not include all activities of NRDL. Buildings 364, 365, 506, 529, 707, 816, 820, 821, 830, 831, and ICW 418 were also used by NRDL until it closed in 1969.

Other Radiation Generators

In addition to the use of radioactive isotopes, NRDL owned several machines that used electrical energy to generate radiation and charged particles. The following devices are known to have existed at NRDL:

- X-ray machines in Building 815
- Low-power neutron generator in Building 506
- A 600-kilovolt (kV) Kevatron particle accelerator in Building 510A
- A Van de Graaff particle accelerator in Building 816
- A Cyclotron particle accelerator in Building 820

NRDL used these devices to calibrate instruments and to irradiate animals and materials. Details of the locations for these devices are in Section 8.0 of the HRA (Navy 2004). Because these machines did not contain radioactive materials, they could not have impacted the buildings in which they were located by direct contamination. However, radioactive materials were used as targets for the particle generators, particularly the Van de Graaff and Kevatron generator. The primary isotope used as a target was H-3. There had been concerns about H-3 contamination at and around Building 816 where the Van de Graaff had been located. Surveys of this area were done in 1970 and 1993. The 1993 survey is discussed in Section 6.4 of the HRA (US Navy, 2004).

Waste Disposal Operations

From the late 1940s through 1959, NRDL and HPS conducted radioactive waste disposal operations. NRDL accepted and consolidated waste from other military installations, as well as educational institutions, research laboratories, and the AEC, and packaged the wastes for disposal. NRDL then worked with HPS to load the containers onto barges and to ship the material to an ocean disposal site near the Farallon Islands. NRDL was the primary military agency disposing of waste at the Farallon Islands. Commercial agencies also disposed of waste there during this time period. In general, the generator notified NRDL that they had waste for disposal. Funding documents and cost estimates were created. The waste materials that were shipped into HPS were received and stored at the Building 707 waste storage area. The waste packages primarily consisted of 55-gallon drums. However, concrete casks were also designed and used for disposal of larger items. Numerous types and forms of radionuclides and various experimental media were included in the waste. Carcasses of small animals used in research were packaged in drums; large ones were either packaged in larger containers or cut up and put into drums. Concrete was added to the waste to weight the drums. Once at the disposal location, the containers were off-loaded and sunk. Should a drum not sink, it was fired upon with rifles until it sank. If it could not be sunk, it was recovered and returned to HPS. Waste processing, packaging, and disposal activities were detailed in NRDL procedures. Complete historical records documenting the exact inventories of waste disposed of or the number of containers shipped from HPS was not found. However, several NRDL annual reports do provide some details. An NRDL letter of 1958 summarized a total of 1,780 tons of DoD waste dumped at sea from 1954 to August 1958. A U.S. EPA report written in 1980 estimates that 47,500 containers, mainly 55-gallon drums containing 13,500 curies of radioactive waste, primarily short-lived radioisotopes, were disposed of at the Farallon Islands from 1946 to 1970.

All radioactive liquid waste was collected from the various laboratories and processed in a liquid radioactive waste holding tank outside Building 364. Once the tank was full, acidic or basic waste was neutralized, if necessary, and disposed of through a commercial company that pumped the waste from the tank and removed it from HPS for further processing and disposal at an off-site licensed disposal facility. In addition to off-site waste disposal, small amounts of low-level radioactive liquids were authorized for release via the site drainage or sanitary sewer systems. Because it was permitted by regulations of the time, it is reasonable to assume that NRDL disposed of small amounts of low-level liquid effluents through the building drains. These releases would have included dilution to ensure that they met the AEC release limits.

Summary

The use of G-RAM at the shipyard is well documented throughout its history. HPS sites impacted by shipyard G-RAM use are detailed in Table 6-1 of the HRA (Navy 2004).

PREVIOUS STUDIES

HPS – Parcels A-F Overview

Since the beginning of radiological operations at HPS in 1946, radiological investigations and removal actions have been conducted by various groups and regulatory agencies to assess and remove residual G-RAM resulting from these operations. NRDL, Navy contractors, regulatory agencies, and RASO have conducted various radiological surveys and studies to evaluate residual radioactive contamination and risks from radiological operations at HPS through the years. These investigations and surveys include:

- 1946 through 1948 RSS and NRDL surveys and decontamination of OPERATION CROSSROADS ships and drydocks

- 1955 NRDL surveys to decommission NRDL buildings at HPS
- 1969 NRDL survey for disestablishment of NRDL
- 1969 to 1970 AEC survey to verify NRDL's survey results and release buildings for Reuse
- 1974 HPS survey for base closure
- April 1978 LFE Environmental Analysis Laboratories, Inc. (LFE), survey of Building 815
- July 1978 RASO survey of Building 815 to confirm LFE survey findings
- September 1978 RASO survey of former NRDL buildings
- 1979 RASO resurvey of Buildings 364, 815, and 816
- 1986 EPA harbor survey at NNPP request
- 1988 to 1989 Harding Lawson Associates (HLA) site reconnaissance
- 1991 to 2001 surveys conducted for the RI program in four phases: Phases I through IV, including the following interim investigations:
 - 1997 Parcel E radiation risk assessment
 - 1999 to 2001 interim investigations between the Phase IV and Phase V investigations
 - 2001 to 2003 Phase V investigations and removal actions

1946 through 1948 OPERATION CROSSROADS Surveys

OPERATION CROSSROADS ships were decontaminated from 1946 to 1948 at Drydocks 3, 4, and 6 and various berthing spaces. After each ship was decontaminated, Navy personnel performed a radiological survey and decontamination of the drydock. The most effective decontamination method was sandblasting the contaminated surfaces of a vessel. In general, spent sandblast wastes containing "all rust and marine growth" were containerized and disposed of by ocean disposal. Other spent sandblast materials and decontamination solutions were authorized for disposal to the Bay. During 1946 and 1947, radioactive wastes from these activities were disposed of in an approved zone at least 10 miles at sea, or beyond the 100-fathom curve (contour line indicating an ocean depth of 600 feet). After removal of the sand, the drydock floor was washed down vigorously and the water pumped into the harbor. Surveys of the drydocks were performed after undocking of the ship. Documents from 1947 indicate that Drydocks 3, 4, and 6 were at background levels when surveyed by Navy personnel, except for two anomalies found at Drydock 4. However, they met the cleanup criteria for release using radiation detection instruments available at the time.

Previous Radiological Studies Including Parcel F Sampling

Previous studies at Parcel F include the Environmental Sampling and Analysis Plan (ESAP) program, qualitative and quantitative ecological risk assessments (ERAs), and a draft FS. The ESAP program was conducted in 1991 to evaluate the presence of contaminants in offshore areas and included measurements of sediment and water chemistry and toxicity (Aqua Terra Technologies [ATT], 1991). A Basewide Phase 1A ERA was conducted from 1991 through 1994 and included a qualitative assessment of offshore areas (PRC Environmental Management, Inc. [PRC], 1994). The Phase 1B ERA (PRC, 1996) was conducted from 1994 through 1996 and addressed the data gaps identified in the Phase 1A report. Additionally, some data from the intertidal zone were collected during investigation of specific Installation Restoration (IR) sites in the upland part of HPS (TtEMI, 1997).

A draft FS report was submitted to regulatory agencies for review in April 1998 (TtEMI and LFR, 1998). The draft FS report presented high-volume and low-volume remediation footprints based on two different decision flow processes, with the high-volume footprint based on a more conservative set of criteria. The initial criteria used to define the low-volume footprint were effects range-median (ER-M) values (Long and Morgan, 1991; Long et al., 1995) and bioaccumulation criteria for

polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDT). The low-volume footprint consisted of five areas, as shown in Figure 1-1.

A HPS Parcel F Data Summary Memorandum was prepared in late 1999 to summarize existing sediment chemistry data, evaluate existing bioassay data, present results of a bioassay pre-test study that evaluated the potential influence of confounding factors on previous bioassay results, present proposed dose assessment refinements, and identify the uncertainty associated with each component of the existing data set (Battelle et al., 1999). The Data Summary Memorandum was intended to provide a common understanding of the site and a starting point for technical discussions with regulatory agencies and co trustees in order to establish a path forward for Parcel F.

Historical site activities at HPS resulted in the release of chemicals to the environment, including offshore sediments. Environmental restoration activities are conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The facility was closed under the Defense Base Realignment and Closure Act of 1990 (BRAC) and is in the process of conversion to non-military use.

1986 EPA NNPP Operation Investigation

In 1984, the NAVSEA requested that EPA conduct harbor surveys at all active facilities servicing nuclear-powered warships. In September 1986, EPA collected bottom sediment, water, and biological specimens near the drydocks and pier areas at HPS, including Drydocks 2, 3, and 4 and Berths 2 and 17, where nuclear-powered warships had been berthed or serviced. The study focused on Co-60 because it was the predominant radionuclide associated with NNPP operations. However, the gamma spectroscopy performed would have also identified other gamma-emitting radionuclides if they were present. Water samples were also analyzed for H-3. This investigation included both field gamma radiation surveys and sample analyses. An underwater gamma survey was conducted using a sodium iodide (NaI) scintillation detector to locate any areas of elevated radioactivity. Sediment samples were collected from the detector measurement locations. One core sample was collected from the Drydock 4 area to determine the vertical distribution of radioactivity in harbor bottom sediment, and surface water samples were also collected near this drydock. Vegetation (sea lettuce) and mussel samples were collected from the Bay. The underwater gamma scintillation probe did not detect any areas on the harbor floor where radioactivity levels exceeded background levels. Only naturally occurring nuclides and trace quantities of Cs-137, at levels typically associated with fallout from previous worldwide nuclear weapons testing, were detected in the sediment samples. Surface water samples contained no H-3 exceeding the MDA of 200 picocuries per liter (pCi/L). Potassium 40 (K-40), a naturally occurring radionuclide, was the only gamma-emitting radionuclide detected. Biological samples of sea lettuce and mussels all contained small quantities of naturally occurring radionuclides. The gamma exposure rates averaged 4.4 ± 0.4 microrems per hour ($\mu\text{rem/hr}$), which is comparable to measured background levels of 4.1 ± 0.2 $\mu\text{rem/hr}$. This radiological survey concluded that only naturally occurring radionuclides and trace amounts of Cs-137 from fallout were detected at HPS. Based on this survey, EPA concluded that operations related to nuclear-powered warship activities contributed no detectable radioactivity to Drydocks 2, 3, or 4 or Berths 2 and 17.

1994 Drydock 4 Surveys (MINS and PRC Environmental Management, Inc. (PRC))

An earlier radiological investigation performed by MINS personnel identified a possible Ra-226 point source at Drydock 4. MINS personnel did not remove the point source because it did not contain Co-60, the radionuclide of concern for the survey. Subsequently, MINS conducted another survey on 21 July 1994, and removed the Ra-226 point source. In September 1994, PRC conducted a radiological survey at

the drydock to confirm that no radioactivity exceeding background levels remained. The radiological survey consisted of a 100-percent walkover gamma survey of the drydock floor area using a NaI detector, a gamma detector, and an exposure rate survey instrument. Sediment samples were also collected at each location where an anomalous gamma count rate was observed for gamma spectroscopic analysis. This survey confirmed that no G-RAM remained at the drydock exceeding background levels. The Navy leased Drydock 4 to a civilian business in September 1994.

New World Technology (NWT) Phase V Investigations

Beginning in January 2002, NWT conducted scoping and Characterization Surveys, soil and other media sampling programs, remediations, and Final Status Surveys at various areas and in various buildings at HPS in accordance with MARSSIM guidelines. The Phase V Investigations were conducted within a standard protocol that allowed for application of MARSSIM guidelines in the survey process. Each site was assessed for potential radionuclides of concern with surveys designed according to the MARSSIM area classification (Class 1, 2, or 3). In general, the surveys included gamma scans, gamma static readings, alpha/beta static readings, dose rate measurements, alpha/beta swipes, H-3 swipes (if appropriate), and sample analysis (alpha or gamma spectroscopy or beta analysis, as appropriate). The extent of the surveys depended upon the classification of the area. Class 1 surveys covered 100 percent of the area, Class 2 surveys covered 50 percent of the area, and Class 3 surveys covered 20 percent of the area. Static measurements were distributed accordingly. If contamination was found in a Class 3 area, a 100 percent Characterization Survey was conducted followed by remediation as appropriate. A Class 1 Final Status Survey followed these actions.

Previous Environmental Studies at Parcel F

Previous environmental studies at Parcel F include the Environmental Sampling and Analysis Plan (ESAP) program, qualitative and quantitative ecological risk assessments (ERAs), the draft Feasibility Study, and the Validation Study that supported the Draft Feasibility Study. The base-wide Phase 1A ERA was conducted from 1991 through 1994 and included a qualitative assessment of offshore areas (PRC, 1994). The Phase 1B ERA (PRC 1996a and 1996b) was conducted from 1994 through 1996 and addressed the data gaps identified in the Phase 1A report. The Validation Study was submitted in 2005. Additionally, some data from the intertidal zone were collected during investigation of specific Installation Restoration (IR) sites in the upland part of HPS.

Site summary for Parcel F from the HRA (Navy 2004)

Underwater Areas

Site Description: Underwater areas that encompass the property line of the shipyard, and waterways under ships' docking and berthing areas.

Former Uses: Shipyard waterways. May have been radiologically impacted by OPERATION CROSSROADS decontamination operations underwater experimentation, radioactive waste disposal accidents, contaminated water discharges, and storm and sewer discharge.

Current Uses: Open Water.

Radionuclides of Concern: Cs-137, Pu-239, Ra-226, Sr-90, and U-235.

Previous Radiological Investigations: None for G-RAM.

Contamination Potential: Likely in areas of OPERATION CROSSROADS decontamination activities and areas containing outfall discharge from the storm drain and sanitary system.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan)

Revision: NA

Revision Date: NA

Potential Contamination Assessment (by matrix):

Surface Soil: Low
Subsurface Soil: Low
Sediment: Low
Surface Water: Low
Groundwater: None
Air: None
Structures: None
Drainage Systems: None

Potential Migration Pathways:

Surface Soil: Low
Subsurface Soil: Low
Sediment: Low
Surface Water: Low
Groundwater: None
Air: None
Structures: None
Drainage Systems: None

Recommended Actions: Scoping Surveys in areas of OPERATION CROSSROADS decontamination activities and site outfall discharge.

All Ships' Berths

Site Description: Standard berthing spaces, including piers.

Former Uses: Berthing of OPERATION CROSSROADS ships, berthing of the YGN-73 (radioactive waste disposal barge), and NRDL usage (berthing of experimental barges and YAGs-39 and -40).

Current Uses: Unused.

Radionuclides of Concern: Cs-137, Pu-239, Ra-226, and Sr-90.

Previous Radiological Investigations:

2002 NWT Phase V investigations of Berths 15, 16, 17, 18, 19, and 20 at Gun Mole Pier. Areas containing Cs-137 slightly exceeding limits identified.

Contamination Potential: Likely.

Contamination Assessment (by matrix):

Surface Soil: Low
Subsurface Soil: Low
Sediment: Low
Surface Water: Low
Groundwater: None
Air: None
Structures: Low
Drainage Systems: None

Potential Migration Pathways:

Surface Soil: Low
Subsurface Soil: Low
Sediment: Low
Surface Water: Low

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

Groundwater: None

Air: None

Structures: Low

Drainage Systems: None

Recommended Actions: Review Final Status Survey report for completed berths. Scoping Survey for the remainder.

Site Name: Parcel F Hunters Point Shipyard
Site Location: San Francisco Bay, CA

Title: Sampling and Analysis Plan (Field Sampling Plan and
Quality Assurance Project Plan)
Revision: NA
Revision Date: NA

ATTACHMENT B:
Standard Operating Procedures

**Battelle
Applied Coastal and Environmental Services
Standard Operating Procedure**

for

COLLECTION AND AT-SEA PROCESSING OF BENTHIC GRAB SAMPLES

Summary of Changes to this version: The text in the SOP has been updated to include additional procedures for measuring Redox Potential Discontinuity (RPD) and elutriation for benthic infauna sample processing. Some nomenclature was corrected.

1.0 OBJECTIVE

This SOP describes the collection and at-sea processing of benthic grab samples for chemical, biological and geophysical analyses.

2.0 PREPARATION

2.1 SUPPLIES AND EQUIPMENT

- Grab Sampler: Young-modified Van Veen, Van Veen, Smith-McIntyre, Ponar, or similar
- Stand for grab sampler
- Bucket with pour spout
- Weights and mudshoes for controlling penetration
- Sieving system such as, but not limited to, the following:
 - Table with bucket rocking assembly
 - Elutriation device (e.g. Mudmaster)
 - Sieves (for hand sieving)
- Water filter unit with extra clean filters (5 micron nominal pore size or as specified in the Quality Assurance Project Plan (QAPP))
- Hoses and fittings for the filter system
- Water pump for filter unit (may be supplied by vessel)
- Sieves, common mesh sizes are 0.3mm, 0.5 mm, 1.0mm. Determine and adhere to specifications provided in the QAPP
- Sample containers: As specified in the QAPP. Containers typically consist of plastic wide-mouth jars with effective, strong sealing lids (to contain formalin) in various sizes for infauna; polyethylene bags or jars (glass or plastic) for Grain Size; certified clean glass or plastic jars with teflon-lined screw caps for chemistry (metals and organics); and sterile specimen cups for microbiology
- Squirt bottles holding site water, distilled water, and/or solvent for rinsing and decon, as specified by the QAPP
- Funnels for transferring sample from sieve to jar
- Tape: electrical and Teflon® (or similar) tape for sealing sample jar lids. Clear packing tape may be required for securing/protecting paper labels but is not necessary for vinyl labels
- Writing tools e.g. ink pens, permanent markers, pencils, and grease pencils
- Ruler (strong for inserting into the grab and measuring sediment depth)

- Plastic syringes for measurement of RPD and/or collection of VOA sample as required by the QAPP
- Scoops for removing chemistry subsamples if required (use of flat scoops built to the height of the target sample depth is preferred when possible)
- Bristle brushes for cleaning grab between stations (several sizes are helpful for different sediment consistency and different areas of the grab)
- Non-phosphate detergent for cleaning grab between stations (e.g. Alconox® or Liquinox®).
- Common equipment and supplies that are not always required: forceps, disposable spoons, small secondary sieves

2.2 REAGENTS

- Formalin at a concentration of 37-40% formaldehyde (this is the maximum concentration of formaldehyde in water and is commonly referred to as 'Full Strength Formalin' even though it is not 100%) or formalin diluted to a lower (safer) concentration. All containers holding formalin need to be stout, able to seal very effectively, and well labeled. Note that most macro-benthic organisms are preserved in 10% formalin which is the same as, and can be described as, 3.7% formaldehyde. Be very careful not to confuse the units and designations of formalin and formaldehyde.
- Sodium Borate (e.g. Borax®) to buffer the formalin

2.3 SOLVENTS (FOR CLEANING EQUIPMENT BETWEEN STATIONS)

Solvents and the decontamination process are specified in the QAPP. Solvents typically consist of one or more of the following

- Acetone
- DCM (Dichloromethane)
- Alcohol (e.g. methanol, ethanol)
- Hexane

2.4 PREPARATION

The QAPP will specify the appropriate sediment grab sampler. Table 1 provides guidance for selecting a grab sampler.

1. Set the grab sampler on a stand under the sheave for the cable (place as directly below the pick up point as possible to minimize swinging when it is lifted) Attach the cable termination to the grab with a shackle. Seize the shackle(s) (secure shackle pins from unscrewing) with cable ties, seizing wire, or other suitable method. Use an appropriate swivel with the shackles when performing deep-water operations.
2. Place the sieve table or other sample process systems in a convenient location on deck and secure equipment to the vessel (e.g. to cleats, rails, deck).
3. If sample sieving is performed, position the outlet stream from the sieving apparatus through a scupper or over the side of the vessel so most sieved sediment runs overboard and not onto the vessel deck.
4. If filtered water is required in the QAPP, set up the water filter system by inserting a clean filter, connecting the supply and discharge water hoses, and securing it to the vessel and/or sample processing system.

5. If required by the QAPP, run another hose from the filter outlet to the grab sampling area for washing sediment from the grab for organism sieving and grab cleaning between samples. Decontamination procedures are described in Section 3.2.

Table 1. Grab Sampler Descriptions and Guidance for Use.

Grab Type	Typical Open Jaw Dimensions	Guidance for Use
Young-Modified Van Veen	~20 x 20 cm (0.04 m ²) or ~31.6 x 31.6 cm (0.1m ²)	The Young modification refers to the conical-shaped frame that surrounds the grab sampler. <i>Advantages:</i> The Young modification improves the grab's ability to maintain a level position on the bottom, allows penetration in more compact sediment by easy addition of weight, and can prevent over penetration in soft sediment with addition of a base shelf. The system collects a very consistent sample volume with minimal disturbance of the sediment while providing a high acceptance rate. The system can be used in very deep water (>1,000m). Two hinged doors on the top of the grab allow easy access to collect surface sediment for chemistry analysis (when required). <i>Disadvantages:</i> Heaviest and bulkiest grab requiring heavy duty mechanical lifting mechanisms with enough height to clear the vessel rails.
Van Veen	~20 x 20 cm (0.04 m ²) or ~31.6 x 31.6 cm (0.1m ²)	<i>Advantages:</i> Simple grab design, lighter and deployable by hand. Works well in calm shallow water (<20 meters). Collects samples without excessively disturbing the sediment. <i>Disadvantages:</i> Vessel needs to be completely stationary, more prone to uneven sample collection and pre-tripping.
Smith-McIntyre	~31.6 x 31.6 cm (0.1m ²)	Spring driven positive jaw closing system. <i>Advantages:</i> Spring aided system enhances sample collection with less weight than Young Modified grab. <i>Disadvantages:</i> Spring closure system is complicated, prone to pre-tripping and not tripping, and is a greater safety risk to the operator(s).
Ponar	~15.2 x 15.2 cm or ~22.9 x 22.9 cm	<i>Advantages:</i> Very small and light weight. Easy to deploy by hand in wetlands and very small vessels such as a canoe or kayak. <i>Disadvantages:</i> Poor ability to penetrate through hard sediment (e.g. stiff clay), consolidated material, gravel, or thick detritus. Limited access through top for collecting thin layers of surface sediment, small sample volume, inconsistent tripping of release mechanism. Consider piston core sampler as alternative if small volumes are needed.

2.5 OPERATION

2.5.1 General Grab Sampling Safe Operating Procedures

Carefully read and understand the following safety procedures prior to working on a vessel with sediment grab sample equipment.

- Be very careful at all times where you place your hands. In general, your body is exposed to a high amount of risk from the grab falling unexpectedly, rising unexpectedly, closing unexpectedly, and swinging while suspended in the air. Any of these situations can cause serious harm to any part of your body, especially hands and feet. To minimize the risk, during operations follow these procedures:

- Avoid placing your hands under the grab or the grab frame.
- Always leave a path for your hands, arms, and feet to move and quickly if you need to let go of the cable and trigger mechanisms.
- Never place your hands in between the cutting edges of the jaws.
- Keep your hands on top of equipment while it is being lowered into the water or lowered on the deck since gravity will cause the grab to drop rapidly if a cable or hydraulic system fails. Your hands are safest while positioned on top of an equipment surface and with an open exit path.
 - Also be very aware that the hydraulic system could also fail during lifting of the grab or the winch operator could make a mistake and lift when they should not be lifting so you need to be aware of lower, upper, and lateral pinch points for your body at all times.
- Keep your hands at a mid point when lifting the grab. Avoid placing your hand or body in between the top of the grab and overhead points such as the sheave the cable travels through or the lifting frame (e.g. davit or A-frame).
- Avoid placing your feet under the grab when it is hanging on the cable and in the air.
- Do not stand or place any body part (e.g. resting a hand on the vessel rail) in the vicinity of the operations, and specifically avoid standing between the grab and the side of the vessel or the lifting equipment. The grab swings during deployment and recovery, sometimes erratically, as the vessel rocks. The swinging grab can cause serious injury.
- Assume the winch, cable, and/or sheaves can fail at any time and the operator can make a mistake at any time. Thus:
 - Avoid standing under the cable system when there is tension (weight) on it.
 - Do not stand under a grab suspended in the air.
 - Agree on clear hand signals, avoid excess talking during deployment and recovery operations, and do not stand in the lines of sight between the winch operator, captain, and equipment being deployed.

2.5.2 Young-Modified Van Veen Sampler

1. Secure each door on the top of the grab by using the grab specific system (e.g. tightening the wing nuts, cable ties, twine).
2. Provide slack in the cable attached to the sampler to allow the arms of the firing mechanism to flatten and the jaws to open completely. The arms of the sampler should be approximately parallel to the deck when fully open.
3. Secure the metal 'L' hooks (sometimes referred to as self releasing 'Pelican Hooks') on the upper arms onto the pegs on the arms attached to the jaws.
4. Hold the hooks engaged to the pins by hand or by applying tension to the cable above the shackle.
5. While holding the hooks in place, instruct the winch operator to gently apply tension to the cable, to engage the hooks allowing the trigger system to hold the arms open and firmly in place.

Grab Specific Safety Issues:

- Be aware when tension is released from the cable. The arms can collapse and cause injury if they fall rapidly.

- Be extra careful not to hold or otherwise stabilize the grab by holding the bottom ring with your hand under the ring. Use a bracket on top of the ring (if provided), a vertical post, or grab only the top part of the ring. It is very natural and tempting to place your hand around the bottom ring, but if the grab falls rapidly it could be difficult to release your grip fast enough or you may forget your hand is under the grab and the falling grab can pinch your hand potentially causing severe injury.

2.5.3 Van Veen Sampler

1. Secure each door on the top of the grab by using the grab specific system (e.g. tightening the wing nuts, cable ties, twine).
2. Engage the grab specific trigger system (e.g. 'Pelican Hook'). The trigger system will hold the jaws of the sampler open during deployment.
3. Hold the release engaged by hand or by applying tension to the cable above the shackle.
4. If equipped with a safety pin (typically attached to the sampler), insert it through the hole in the 'Pelican Hook'. This prevents the accidental firing of the sampler while it is being lifted for deployment or on the deck and not in use.
5. While holding the release locked in place (or with the release safety pin inserted), instruct the winch operator to gently apply tension to the cable, to engage the hooks allowing the trigger system to hold the arms open and firmly in place.

2.5.4 Smith-McIntyre Sampler

1. Secure the lids on top of the sampler buckets by using the grab specific system (e.g. tightening the wing nuts, cable ties, twine). This prevents the loss of sample through the top.
2. Lift the bucket arms up until the catches on the support bar of the pressure plates are engaged. The buckets are held open by these catches.
3. Insert the hook of the cocking bar through the ring on top of the sampler.
4. Lift both pressure plates. This moves the firing assembly up; it usually requires two people.
5. Pull the cocking bar downward to compress the firing springs.
6. To engage the cam and hold the bucket assembly in the cocked position, slam the pressure plates down.
7. Check the catches to be sure that they are securely in place. If they are not securely in place the sampler could unintentionally fire and flip the cocking bar out of place away from the sampler.
8. Carefully remove the cocking bar. Note the pressure of the bar. If no pressure is detected, it means that the sampler is cocked; if pressure is detected, the sampler is not cocked and steps 4-8 must be repeated.
9. Insert the safety pins (typically attached to the sampler) through the cams. This prevents the accidental firing of the sampler while it is on deck and not in use.

2.5.5 Ponar Sampler

- 1) Provide slack in the cable/line attached to the sampler. Spread the arms of the sampler so that they lay parallel on the deck.

- 2) Engage the trigger mechanism (following are instructions for two common Ponar systems) just prior to deployment (do not trigger grab until beginning the deployment process).
 - (a) Spring loaded pin system
 - Position the two arms so the holes for the trigger pin are aligned
 - Insert the spring loaded pin through both holes
 - Put tension on the pin by lifting the arms which puts friction on the pin and prevents the spring from pushing the pin out of the holes and releasing the grab.
 - Apply tension to the line by hand (if a hand deployment) or instruct the winch operator to apply tension to the cable to hold the pin in place during deployment.
 - (b) Tab lock system
 - Secure the metal tab locks, located on the upper arms, underneath the lower arms
 - While holding the metal tab locks in place, apply tension by hand or instruct the winch operator to apply tension to the cable, to hold the locks in place.

3.0 PROCEDURES

3.1 COLLECTION OF BENTHIC SEDIMENT SAMPLES

1. When vessel is on station, direct the winch operator to slowly lift the grab from its stand. During its ascent and while the boom swings overboard, the grab can be steadied with hands, lines, or boat hooks. If the grab has a safety release pin (or similar system), remove the safety device at the last safe point in the process. Typically this is when the grab has just cleared the vessel side or stern, is within easy reach but is hanging over the water and is no longer at risk to fall on or hit field staff. After assuring all hands are free and the grab is properly triggered, the winch operator deploys the grab by paying out the cable slowly as it passes through the air-water interface. After the grab is submerged, pay out the cable at as steady a rate as possible. Hitting the water too fast and sudden stops and starts of winch should be avoided because they can cause the grab to bounce, releasing tension on the cable, and potentially pre-releasing the trigger mechanism resulting in no sample collection. This is especially critical on deep water deployments where deployment time can be significant.
2. When the cable goes slack, the grab is on the bottom. If NavSam[®] or a recording GPS system are being used, instruct the NavSam[®] or GPS operator to save the location data at this time. Alternatively, site coordinates can be manually recorded on the station log. Initiate recovery slowly, until the grab is free from the bottom. After that, retrieve the cable at a steady rate, until the grab is visible near the surface. When the grab is visible, slow the rate of ascent so that it can be retrieved safely and more easily steadied as it is brought on board.
3. Set the sampler on the stand (if available), open the lid and inspect the sample for acceptability. An acceptable grab is one that displays the following characteristics:
 - Sampler is not overfilled with sediment, the jaws are fully closed and the top of the sediment is below the level of the open doors.
 - The overlying water is not excessively turbid.
 - The sampler is at least half full, indicating that the desired penetration has been achieved.
 - The sediment is level on at least one side.

In certain locations, slight over-penetration may be accepted, at the discretion of the chief scientist. The chief scientist will make the final decision regarding acceptability of all grabs. The overall condition of the grab (i.e. “slightly sloped on one side”) should be noted on the station log (Attachment 1). Penetration depth can be controlled to some extent by the addition or subtraction of weights and/or “mud shoes” on the frame of the grab if possible.

4. Information on every grab collected is recorded on the station log. The QAPP provides the data log sheet and details the information required to be recorded. If the grab is rejected, record the reasons on the station log, along with other pertinent station information. For an example of a collection log, see Attachment 1: *Station Log for Benthic Sediment Grab Samples*)
5. If the sample is rejected, empty the grab, wash it thoroughly with site water, and re-cock the sampler. Note that decontamination cleaning procedures (section 3.2) are not required when the grab is redeployed at the same station. The sampling procedure is repeated until an acceptable grab is obtained or the station is abandoned or moved following guidance in the QAPP or following direction provided by the Project Manager and following corrective action requirements stipulated in the QAPP.

3.2 DECONTAMINATION CLEANING PROCEDURES

Sampling apparatus that comes into contact with sample matrices will be decontaminated in the field to minimize cross-contamination between sampling stations. While performing the decontamination procedure, “phthalate-free gloves,” such as nitrile or butyl rubber, will be used to protect the field staff as well as preventing contamination of the sampling equipment or the samples.

Unless the QAPP directs otherwise, the decontamination procedure specified in EPA Region II, CERCLA Quality Assurance Manual (October 1989, Revision 1) will be used prior to each station for sampling equipment that comes into direct contact with the media to be sampled. Equipment to be used during the sample processing will also follow the same decontamination procedure. The EPA Region II procedures are summarized below (solvents used during decontamination activities will be collected and stored for disposal at the laboratory):

1. Rinse equipment with tap water or site water
2. Scrub equipment with 1% non-phosphate soap (e.g. Alconox®) using a stiff brush
3. Rinse with tap or site water, then Milli-Q water
4. Rinse with appropriate solvent (as described in QAPP). In general, solvent will not be used unless an oily sheen is noted. Typical solvent rinse procedures are as follows:
 - a. Chemistry, *organic and inorganic*: Begin with a solvent rinse of acetone and then DCM if oily contamination is apparent and will only be used on metal/stainless steel surfaces
 - b. Microbiology (*Clostridium perfringens*, *Enterococcus sp.*, or fecal coliform): Rinse with 70% ethanol solution
 - c. Let air-dry if solvent is used.

Note: All waste solvents must be captured and disposed of in labeled liquid waste containers. All equipment that comes into contact with the sample (i.e. syringe, ruler, collection buckets) must be cleaned using the same general procedures as the grab.

3.3 COLLECTION OF SEDIMENT SAMPLE FROM THE GRAB

3.3.1 Initial Observations

Volume Determination: Once the grab is deemed acceptable, processing begins. Measure the penetration depth of the grab by inserting a clean ruler into the sediment near the center of the sample. Use a grab specific chart of penetration depth versus volumes (see example in Attachment 2), to determine the approximate volume of the sediment. Record the depth and corresponding volume on the station log (Attachment 1). It is important that all sediment is retained if the grab is collected for infaunal analysis (see section 3.3.2). If the grab is going to be analyzed for infauna, then the ruler should be rinsed over the grab so that all of the adhering sediment (and potentially hard to see organisms) washes back into the sample.

Redox Potential Discontinuity: For some programs, an estimate of the apparent Redox Potential Discontinuity (RPD) layer will be determined. To measure the RPD layer, insert a syringe (typically 2.54 cm diameter) into the sediment and withdraw a sediment core. Estimate the distance from the surface of the sediment to the upper portion of the subsurface sediment (color change, if visible) to the nearest mm and record the depth on the station log (Attachment 1). Another method of measuring RPD is to utilize a ruler rather than a syringe. After pushing the ruler into the sample near the center of the grab to determine the sediment penetration depth, pull the ruler gently to one side and expose a cross section of sediment. Visually estimate where the RPD based color change is on the other side and record the depth (nearest mm) on the station log (Attachment 1).

For both methods, if the grab is collected for infaunal analysis, the contents of the syringe and all adhering sediment to the syringe or ruler must be washed back into the sample as described above. For all other analyses, the sediment may be discarded.

Describe the sediment in terms of color, lithology, type, structure, and odor. Also note other distinguishing characteristics such as shell hash, detritus, or presence of an organic sheen. Attachment 3 provides a reference.

Lithology: The description or physical characterization of the soil such as clay, silt, or sand.

Type: a more descriptive means of describing the soil characters such as soil size and composition.

Color: a very important aspect of the sediment description and soil identification. Any changes in color should be noted on the sample log along with the location of the color boundary. If required by the project QAPP, a Munsell Soil Color Chart (Geotechnical Gauge) can be used to acquire uniform descriptions.

Structure: physical layout of the sediment. Below are descriptions of the ASTM criteria noted on Attachment 3:

- *Homogeneous:* Same color and appearance throughout
- *Stratified:* Alternating layers of varying material or color with layers at least 6 mm thick; note thickness
- *Laminated:* Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness
- *Mottled (Lensed):* Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness

Odor: Note any organic or non-organic odors that may be released from the sediment. Many soils have a strong, distinctive odor of decaying vegetation. It is important to also note any chemical or petroleum odors as well as sulfides.

3.3.2 Infaunal Samples

As discussed in Section 3.3.1, all sediments collected for infaunal analysis must be retained, paying particular attention to organisms visible in overlying water or stuck to the sides of the grab or the lids of the screen. Thorough and gentle washing of the entire grab sample into a clean collection bucket is necessary to ensure a representative sample. See Section 3.4 for sample processing and collection.

3.3.3 Chemical, Physicochemical and Microbiological Samples

For acceptable grabs (see criteria in Section 3.1), a subsample is typically collected rather than the entire grab for chemical, physicochemical and microbiological analyses. The depth limit and minimum volume of the subsample is defined in the project QAPP. Samples obtained for chemical analyses (organic and inorganic) are collected with a pre-cleaned utensil as defined in the QAPP, typically a Kynar-coated scoop or stainless steel spoons are used to reduce the possibility of sample contamination. The process is summarized as follows:

- Subsample the grab according to the QAPP requirements and place the sediment in a clean receptacle
- Gently but thoroughly mix the sediment until the texture and color are homogeneous.
- Partition the appropriate sediment volume into the sample containers specified in the QAPP.
- Preserve the samples according to QAPP criteria.

3.4 INFAUNAL SAMPLE PROCESSING

After accepting a grab sample (see criteria in Section 3.1), remove the entire sample from the grab according to Section 3.3.2. Once the entire sample is collected in the bucket, begin the sieving process. Use $\leq 5\text{-}\mu\text{m}$ filtered site water to sieve sediment through clean sieve systems. Confirm required sieve size(s) in the QAPP, (most commonly 12-inch diameter 300- μm mesh sieves). Multiple fractions may be required by the QAPP. If severe plugging of fine mesh sieves occurs, the field chief scientist may choose to use multiple sieve sizes to increase efficiency of the sieving process. If additional sieve sizes are considered, contact the project manager to confirm appropriateness and sample handling details.

Battelle Sieving Table

- Place the bucket containing the sample in the rocking mount on the sieving table, with the spout directed toward the center of the table.
- Place the sieve in the table, over the sink, underneath the spout of the bucket.
- Add filtered site water to the bucket while gently decanting the sample onto the sieve.
- When the sieve starts to fill up with sediment, direct a gentle stream of site water onto the sieve, and try to remove as much of the fine sediment as possible and dislodge material blocking the mesh.
- While sieving, it is important to make sure that the sediment in the bucket is covered with water, and that the sides of the bucket have been washed down, to prevent organisms from drying out.
- The portion of the sample remaining on the sieve after processing is retained for analysis. Wash the contents of the sieve to one side of the sieve using a gentle flow of filtered site water.
- If the sample is made up of heavy material that will not wash through the sieve (i.e. coarse sand, rocks, and shell hash) it may be necessary to modify the sieving scheme to avoid injuring the organisms. This is accomplished by an elutriation procedure. The contents of the bucket are

flooded with site water and gently swirled to encourage the small infaunal organisms to float to the top. The elutriate is then poured off onto the screen. The procedure is repeated until organisms are no longer visible in the elutriate. The portion of the sample retained on the sieve is referred to as the light density fraction; the portion remaining in the bucket is the heavy density fraction.

- Process the sample as described below in 'Benthic Sample Processing'

Sieving by Hand

In wetlands and on small vessels or in other situations where a more equipment intensive operation is not practical, sediment can be sieved by hand. Sieve mesh is specified in the QAPP. Twelve inch diameter brass or plastic sieves with mesh size of 300 microns (μm) is the most common sieve size/mesh. Samples are processed as follows:

- Add mud to sieve directly, or elutriate all or part of the sediment sample by adding filtered water directly into a bucket and gently mixing the sediment and water.
 - After elutriation, pour all or part of the elutriated material into the sieve.
- When the sieve starts to fill up with sediment, direct a gentle stream of site water onto the sieve, and try to remove as much of the fine sediment as possible and dislodge material blocking the mesh.
- While sieving, it is important to make sure that the sediment in the bucket is covered with water, and that the sides of the bucket have been washed down, to prevent organisms from drying out.
- The portion of the sample remaining on the sieve after processing is retained for analysis. Wash the contents of the sieve to one side of the sieve using a gentle flow of filtered site water.
- If the sample is made up of heavy material that will not wash through the sieve (i.e. course sand, rocks, and shell hash) it may be necessary to modify the sieving scheme to avoid injuring the organisms. This is accomplished by an elutriation procedure. The contents of the bucket are flooded with site water and gently swirled to encourage the small infaunal organisms to float to the top. The elutriate is then poured off onto the screen. The procedure is repeated until organisms are no longer visible in the elutriate. The portion of the sample retained on the sieve is referred to as the light density fraction; the portion remaining in the bucket is the heavy density fraction.
- Process the sample as described below in 'Benthic Sample Processing'

Elutriation with Mudmaster

The Mudmaster design works by using constant hydraulic turbulence to separate mud into an elutriate of particles, organisms, and detritus that flows over a weir into a sieve sock suspended in discharge water collected (and constantly draining from) a plastic bucket perforated at the bottom. The bottom perforations allow material smaller than the sieve to separate and escape from the sample contained in the sock. The water is supplied through the bottom of a funnel shaped structure encased in a cylinder or rectangular shaped device. A weir fashioned into a discharge tube allows elutriated water with organisms and fine material to flow into a mesh sieve sock. Material that is too heavy (e.g. rocks, shell, and clumped mud) to flow over the weir remains in the device. Over time (usually 5-15 minutes) the mud is gently elutriated into suspended sediments, organisms, and detritus and flows over the weir into the sock. The Mudmaster procedures are as follows:

- Set up elutriation device with high volume water supply, particle filters, hoses, and valves. Secure system safely by attaching lines to cleats, rails, or similar stout structures in rough seas. Typical

sources of water are ship wash down pumps (if adequate volume), ship fire hose system, or portable 'trash pump' e.g. ~5hp engine with ~2in diameter pump system. On non-biological sampling ships, consider fabricating a plenum system with garden hoses to aid in sample processing and equipment rinsing. Include a discharge port on the plenum to relieve water pressure from the system when sieving or cleaning is not occurring since most water pumps are damaged when run without discharge flow.

- Attach appropriate mesh size sock (as specified in the QAPP) to the Mudmaster and place perforated receiving bucket under the sock.
- Place one or two weirs into the Mudmaster, creating a high discharge level and maximum time in the system for initial elutriation.
- Place a portion of the sample to be sieved in the barrel of the system. The volume of sample depends on the material, start with a small volume of sediment if it contains a large amount of organic detritus that can float and clog the sieve.
- Careful attention must be paid to the sock, especially in unfamiliar or obviously high organic detritus content sediments. A clogged sock can overflow where it attaches to the Mudmaster and sample can be lost requiring discarding the current sample and re-sampling.
- Add mud if the sock is not clogging and the turbidity is decreasing. If the sock is clogging, gently shake, tap, or spray it with filtered water to dislodge clogging material. If necessary, make sure a discharge overflow valve is open and then slow the water flow or stop the flow and empty the sock. Replace the sock and continue the process.
- When all the mud from the sample has been introduced into the Mudmaster and suspended sediment concentration is visibly reduced, remove the weir(s). This promotes a final more aggressive elutriation due to the same input force in a smaller volume of water. Pay close attention to the sock when you remove the weir, the system can clog with the rapid increase of water into the sock. Pull the weir slowly if the sock is clogging.
- Once the water in the Mudmaster and the collection bucket is clear, elutriation is complete. Make sure a discharge overflow is open and then turn off the supply water to the Mudmaster.
- Tilt the Mudmaster so all the water drains out into the sock. If material is observed in the bottom of the funnel, tilt the Mudmaster and turn the water on and flush remaining material into the sock. Some assistance might be necessary to operate the valve and coax the material out of the Mudmaster.
- Often it is easiest and quickest to transfer the material from the sock into a sieve by gently washing the material out of the sock with gentle spray of filtered water.
- Process the sample as described below in 'Benthic Sample Processing'

Benthic Sample Processing

After consolidating material retained in the sieve or sock, place a funnel in an appropriately sized sample container (the sample container should not be more than ½ full of material) and carefully wash the sample through the funnel into the sample container with filtered site water. Be sure to rinse the funnel and to cap the jar to prevent loss from spilling. Continue this process until the entire contents of the bucket has been sieved. With large samples with high detritus content or sticky clays, rinsing through a second smaller sieve can improve the quality of the sample by removing additional fine particles and thus improves the efficiency and quality of the laboratory sample analysis.

Once the entire sample has been sieved and collected in the sample jar, add buffered formalin to obtain the appropriate final concentration as detailed in the QAPP. For seawater sample, the concentration is typically 10% formalin (e.g. 100 mls of formalin in a 1L of water). Fill the jar to the shoulder with site water to minimize organisms drying out on the sides of the jar. Note that in samples with high volume of shells, sand, or other non-biological material, add the amount of formalin based on the water and biota volume, not the container volume (i.e., if within a 1 liter jar 50% of the jar volume is large sand and shells, there will only be 500 mls of water and thus only 50 mls of full strength formalin are required to get the 10% solution. It is good practice to buffer the formalin to reduce dissolving of calcareous shells. Either add sodium borate (e.g. Borax) to the formalin mixture past the saturation point (granules remain on the bottom of the jar) or, add a heaping tablespoon of Borax to the sample. Rotate the jar gently on its side to distribute the formalin evenly throughout the sample. Affix the sample label (cover the label with clear packing tape if the label is not vinyl). Seal the jar tightly and tape the lid with electrical tape to prevent leakage of liquids and fumes during transport.

Whenever a sample is divided into more than one jar, for any reason, each jar must be labeled and label must reflect the jar number and total number of jars for each sample (i.e. 1 of 2). The number of jars should also be noted on the custody form. Sample custody procedures in the field and example custody forms are defined in SOP 6-040.

4.0 CALCULATIONS

There are no calculations necessary for this procedure.

5.0 QUALITY CONTROL

Field replicates and equipment blanks for physical, chemical, or biological analyses will be collected according to the QAPP. Any deviations from this SOP must be documented on the station log in the survey logbook. Careful attention to the procedures described in this SOP by trained, qualified personnel will ensure the quality of the samples collected. A summary of SOP changes are provided in Attachment 4.

6.0 TRAINING

Individuals performing grab sample processing must be trained by a qualified sample processor. A qualified sample processor is considered to be an individual who has performed the processing within two years and for whom a training certificate or equivalent documentation of experience exists. The methods in Section 3.0 are used as the training standard.

A technician training in these methods must first read this SOP in its entirety; all questions should be directed to a qualified sample processor. A qualified sample processor must then demonstrate the procedures listed in Section 3.0 in their entirety with the trainee and then observe the trainee perform the procedures independently. The trainee will then practice the procedures in the field under the watch of the instructor until proficiency is demonstrated.

Once proficiency has been verified, a Certificate of Training (Attachment 5) will be completed for the trainee. The original certificate is maintained in the Quality Assurance Unit.

7.0 SAFETY

All personnel should wear protective clothing, safety glasses, and gloves when handling sample containers or reagent bottles containing the formaldehyde or other solvents. All collectors should wear life vests, steel toed boots, and hard hats when handling the grab on deck.

During training, the qualified sampler should explicitly point out hazards associated with the reagents and or equipment. The trainee should review the material safety data sheets for **Formaldehyde, DCM (Dichloromethane), Acetone, and Ethyl and Methyl Alcohol**.

Gloves, safety glasses (with side shields) and protective clothing such as rain gear that protects from chemical exposure must be worn when handling any of the above chemicals. Open containers must remain in a fume hood or used on deck at sea. If the analyst is exposed to any of the above chemicals the following procedures should be followed:

Skin contact. Remove contaminated clothing immediately, directing a stream of water under clothing while it is being removed, if possible. Wash affected area 15-20 min and ensure no evidence of chemical remains.

Eye contact. Wash eyes immediately with large amounts of water while lifting upper and lower lids for at least 15-20 min. Get medical attention immediately.

Ingestion. If victim is conscious, give large quantities of water immediately. **DO NOT INDUCE VOMITING.** Milk or activated charcoal may also be administered by trained medical personnel. Get medical attention immediately. Contact Poison Control Center and adhere to their advice.

Inhalation. Remove from exposure area to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, oxygen is required. If near shore, an ambulance should meet the boat at the nearest dock. Otherwise, the coast guard should be called.

Analysts using this procedure must read the material safety data sheets (MSDS) associated with these materials thoroughly. MSDS are located in the laboratory and on the boat. In the event of an emergency, the MSDS should be submitted to the appropriate medical personnel.

ATTACHMENTS

- Attachment 1. Example of Station Log
- Attachment 2. Grab Penetration Depth to Sediment Volume Conversion Chart
- Attachment 3. Example of Sediment Classification
- Attachment 4. Summary of Changes to SOP
- Attachment 5. Certificate of Training

APPROVALS

Author



10 DEC 2008

Technical Reviewer



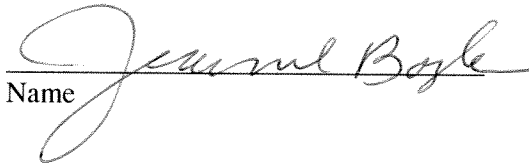
15 December 2008

Quality Systems Manager



DEC 15, 2008

Resource Manager



Name

12/15/2008
Date

Attachment 1.
Battelle- Applied Coastal and Environmental Services

Example of a Benthic Survey Station Log

STATION LOG For Benthic Sediment Grab Samples Project Name:		
SURVEY: DATE: TIME ON STATION:	STATION DEPTH:	Recorded By:
Comments	Sample ID Label	Field Measurements
		Grab Size: 0.04-m ² 0.1-m ²
		Grab Penetration (cm):
		Sediment Texture:
		Redox Depth (cm):
		Analyses: (circle all applicable) SVOC VOC Metals TC GR CL EN/FE FA
		Comment:
		Grab Size: 0.04-m ² 0.1-m ²
		Grab Penetration (cm):
		Sediment Texture:
		Redox Depth (cm):
		Analyses: (circle all applicable) SVOC VOC Metals TC GR CL EN/FE FA
		Comment:
		Grab Size: 0.04-m ² 0.1-m ²
		Grab Penetration (cm):
		Sediment Texture:
		Redox Depth (cm):
		Analyses: (circle all applicable) SVOC VOC Metals TC GR CL EN/FE FA
		Comment:
		Grab Size: 0.04-m ² 0.1-m ²
		Grab Penetration (cm):
		Sediment Texture:
		Redox Depth (cm):
		Analyses: (circle all applicable) SVOC VOC Metals TC GR CL EN/FE FA
		Comment:

VOC = Volatile Organic Compounds SVOC = SemiVOC TC = total organic carbon, GR = grain size, CL = *C. perfringens*, EN/FE = Enterococcus and Fecal Coliform, FA = Infauna

Attachment 2.
Battelle
Applied Coastal and Environmental Services

Example of Penetration to Volume Conversion Chart

Charts Used to Convert Grab Penetration Depth (cm) to Sediment Volume (L)

0.1-m² van Young-modified Van Veen grab sampler.




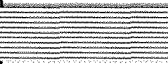





Sediment Volume (L)	Grab Penetration Depth (cm)
3.5	5.5
4.0	6.0-6.5
4.5	7.0
5.0	7.0
5.5	7.5
6.0	7.5
6.5	8.5
7.0	8.5
7.5	9.0
8.0	9.5
8.5	10.0
9.0	10.0
9.5	10.5-11.0
10.0	11.5-12.0
10.5	12.5
11.0	13.0
11.0+	13.5 maximum

0.04-m² van Young-modified Van Veen grab sampler.

Sediment Volume (L)	Grab Penetration Depth (cm)
1.0	4.0
1.25	4.5
1.5	5.0
1.75	5.5
2.0	6.0
2.25	6.5
2.5	7.0
2.75	7.5
3.0	8.0
3.25	8.5 (over penetration)
3.5	> 9.0 (over penetration)

Attachment 3.
Battelle
Applied Coastal and Environmental Services

Example of Sediment Classification

<u>LITHOLOGY</u>	<u>TYPE</u>	<u>DESCRIPTION</u>
	GM	Silty gravels, gravel and silt and sand mixtures
	SW	Well-graded sands, gravelly sands
	SP	Poorly-graded sands, gravelly sands
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
	ML	Silts and very fine sands, silty or clayey fine sands, or clayey silts, with slight plasticity.
	CH	Clays of high plasticity, fat clays
		Shell hash
		Peat/organic matter
<u>CONSISTENCY</u>		<u>MAXIMUM PARTICLE SIZE</u>
Penetration of thumb:		SC = Small Cobble
<0.25 cm = hard (H)		CP = Coarse Pebble
0.25 - 2.0 cm = firm (F)		MP = Medium Pebble
2.0 - 4.0 cm = soft (S)		SP = Small Pebble
>4.0 cm = very soft (VS)		CS = Coarse Sand
		MS = Medium Sand
		FS = Fine Sand
<u>CEMENTION</u>		VFS = Very Fine Sand
N = not cemented		Z = Silt
W = weakly cemented		
M = Moderately cemented		
S = Strongly cemented		
<u>STRUCTURE</u>		<u>ODOR</u>
H = Homogeneous		N = None
S = Stratified		H = Hydrocarbon
L = Laminated		S = Sulfide
M = Mottled		
<u>HCl REACTION</u>		<u>COLOR</u>
N = None		g or gr. = grey
W = Weak		or. = orange
S = Strong		gm. = green

Summary of Changes to SOP

[illegible]

**Attachment 5.
Battelle
Applied Coastal and Environmental Services**

CERTIFICATE OF TRAINING

SOP No. 5-169-03

SOP TITLE: COLLECTION AND AT-SEA PROCESSING OF BENTHIC GRAB SAMPLES

Trainee: _____

Instructor: _____

Date SOP Read: _____

Date Training Completed: _____

Approved: _____ **Date:** _____



NOTIFICATION: THIS PAGE CONTAINS SENSITIVE BUT UNCLASSIFIED INFORMATION WHICH IS PROTECTED BY THE FREEDOM OF INFORMATION ACT

**FOIA Exemption 4 (5 USC 552(b)(4))
Privileged/Confidential Trade Secrets, Commercial, Financial Information**

Pages 152 to 174


YOU MAY APPEAL THIS DECISION

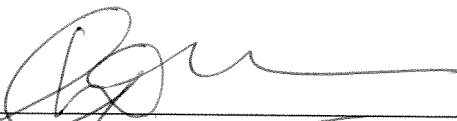
Based on the redaction, this constitutes a partial denial of your request. Because your request has been denied in part, you are advised of your right to appeal this determination in writing.

Please refer to the accompanying correspondence from the FOIA Office for directions and information about the appeal process.

**STANDARD OPERATING PROCEDURE (SOP)
FOR EQUIPMENT DECONTAMINATION**

Originated by:  Date: 11/3/08

Reviewed by:  Date: 11-3-08
Technical Reviewer

Approved by:  Date: 11/4/08
G. Wickramanayake, P.E.

I. SCOPE

This SOP provides equipment decontamination procedures for field sampling conducted by the Environmental Restoration section.

II. PURPOSE

The purpose of this SOP is to describe equipment decontamination procedures ensure that field sampling equipment is free from any detectable contamination.

III. REFERENCES

None

IV. DEFINITIONS

Deionized Water (DI) – Analyte free water that has been passed through ion exchange resin to remove impurities that are ionic.

Detergent: A standard brand of phosphate free laboratory detergent, such as Liqui-Nox®.

Organic Desorbing Agent: A solvent for removing organic compounds, such as isopropyl alcohol.

Inorganic Desorbing Agent: An acid solution for removing trace metal compounds, such as 10% hydrochloric acid.

V. PROCEDURES

A. General Decontamination

1. A decontamination area should be established. A separate tub should be available for each of the first four steps. Each type of water and soap solution can be placed in hand-held sprayers. The analyte-free, DI water needs to be placed in a container that will be free of any contaminants of concern.
2. Special containers will be needed if solvents or acid solutions are used. For example, an acid solution cannot be placed in a sprayer that has any metal parts that will come in contact with the acid solution.
3. Remove particulate matter and other surface debris using and appropriate tool such as a brush or hand-held sprayer filled with tap water.
4. Scrub the surfaces of the contact sampling equipment using tap water and detergent solution and a second brush made of inert material.

5. Rinse contact sampling equipment thoroughly with tap water.
6. Rinse contact sampling equipment thoroughly with analyte-free DI water (not necessary if sampling for disposal profiling purposes).
7. Place contact sampling equipment on a clean surface and allow to air dry.

B. Decontaminating Teflon, Stainless Steel, Plastic and Glass Sampling Equipment

1. Rinse equipment with tap water.
2. Soak equipment in sudsy water solution (Liqui-Nox or equivalent)
3. If necessary, use a brush to remove surface particulate matter.
4. Rinse thoroughly with tap water.
5. If samples for trace metals or inorganic analytes will be collected with the equipment and the equipment is not stainless steel, thoroughly rinse all surfaces with the appropriate acid solution (e.g. 10% hydrochloric acid).
6. Rinse thoroughly with analyte-free (DI) water. Use enough water to ensure that all equipment surfaces are thoroughly flushed with water.
7. If samples for volatile organic compounds (VOCs) will be collected, rinse with isopropanol. Wet equipment surfaces thoroughly with free-flowing solvent. Rinse thoroughly with analyte-free DI water.
8. Allow equipment to air dry. Wrap and seal as soon as the equipment is dry.

C. Decontaminating Sample Tubing

1. If tubing has lost its elasticity (e.g. if used in a peristaltic-type pump), discard the tubing.
2. Transport all tubing to the field in precut, precleaned sections.
3. New tubing should be cleaned according to procedures below unless the supplier provides certification that the tubing is clean.
 - a. New teflon tubing: Rinse outside of tubing with pesticide-grade solvent and flush inside of tubing with pesticide-grade solvent. Dry overnight in drying oven or equivalent (zero air, nitrogen, etc.).
 - b. New polyethylene and polypropylene tubing: Clean the exterior and interior of the tubing by soaking in hot, sudsy water. Rinse the exterior and interior of the tubing with tap water, followed by analyte-free water.

5. Reused Tubing: Cleaning the tubing in the field is not recommended. Clean the exterior of the tubing by soaking in hot, sudsy water. Use a brush to remove any particulates, if necessary. Use a small bottle brush to clean the inside of the tubing ends or cut 1-2 inches from the ends of the tubing after cleaning. Rinse tubing surfaces with tap water, isopropanol and finally analyte-free water. Note: Eliminate the isopropanol rinse for polyethylene or polypropylene tubing. Place tubing on fresh aluminum foil or clean polyethylene sheeting. Connect all of the precut lengths of tubing with Teflon inserts or barbs.

VI. REVISION HISTORY

The SOP was formatted to include the signature page.